Contents—Dec. 1939

Volume XX No. 12

ARCHIVES OF PHYSICAL THERAPY

DISRAELI KOBAK, M.D., Editor

Suite 712 — 30 North Michigan Avenue, Chicago, Illinois

Original contributions, exchanges and books for review should be forwarded to the Editorial Office. All business matters including advertising should be handled through the Executive Office, Suite 712 — 30 N. Michigan Ave., Chicago, Illinois. The statements in the manuscripts published in the ARCHIVES OF PHYSICAL THERAPY, are made solely on the responsibility of the author. The American Congress of Physical Therapy does not assume any responsibility for statements contained therein. Manuscripts accepted for publication in ARCHIVES OF PHYSICAL THERAPY, are for exclusive publication and may not be published elsewhere.

Subscriptions — In the United States, its possessions, and Mexico, $5.00 yearly; Canada, $5.50; elsewhere, $6.50 the year.

Advertising rates on application. All advertising copy subject to acceptance by publication committee.

Published monthly at Chicago, Illinois, by American Congress of Physical Therapy.

Entered as Second Class Matter January 29, 1938, at the Post Office at Chicago, Illinois, under the Act of March 3, 1879.

ORIGINAL ARTICLES

SPECIAL SECTION

OBITUARIES

EDITORIALS

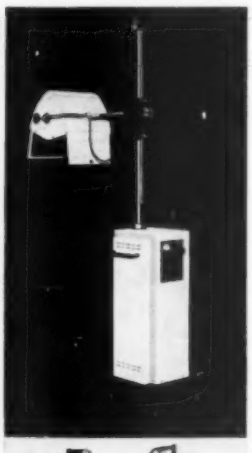
THE STUDENT'S LIBRARY

INDEX

HANOVIA *produces*

the world's finest

THERAPEUTIC EQUIPMENT



①

1 HANOVIA SUPER 'S' ALPINE LAMP

This lamp — foremost in the field of ultraviolet generators — is built for long and useful life and contains many outstanding features . . . It is a high pressure, high intensity quartz mercury arc lamp . . . Starts instantly at the snap of the switch . . . Fast acting — enabling treatment of more patients in less time . . . Ten stages of intensity regulation by unique control . . . At 30 inches from the burner the intensity may be varied from 1,800 to 2,900 microwatts per sq. cm. Ammeter readings provide accurate control of dosage . . . Long burner life — exceptional economy — improved manipulative convenience . . . Adjustment of treatment distance is available up to 40 in. above standard cot.

②

2 HANOVIA ULTRA SHORT WAVE UNIT

A simplified and convenient method of producing heat — deep within the tissues. Ideal for hospital use. Contains many outstanding features of which here are a few . . . Resonance tuning by a single knob control . . . Pre-determined dosage limitation (dosage varies less than 10% with the variation in electrode size) . . . Foolproof plate and filament current switches protect oscillator tubes . . . Ruggedly designed . . . Noiseless . . . No cooling necessary . . . Table terminals bolted to eliminate uncertainty of soldered connections . . . Line voltage compensator for maintenance of proper constant potential upon the plate, grid, and filament of the tube, regardless of changes in supply line voltage . . . All component parts specially designed and manufactured for medical work . . . Inductance cable . . . Nine step autotransformer control for regulating energy supply to patient.

③

3 HANOVIA SOLLUX RADIANT HEAT LAMP

A therapeutic radiant heat lamp provided with either a 1,000 watt incandescent bulb element or a 1,200 watt glowing wire type infrared element. Well ventilated hood may be used in any position, either vertical or horizontal. Equipped with a terraced aluminum reflector providing an especially uniform field with no hot spots . . . This lamp is ideally suited for hospital use. Easily moved from one room to another. Simple and efficient in operation.

Complete information on all Hanovia equipment furnished promptly on request. Address inquiries to

HANOVIA
CHEMICAL & MANUFACTURING CO.
Dept. 306-L Newark, New Jersey

POST-TRAUMATIC PAINFUL ATROPHY OF JOINTS *

RALPH K. GHORMLEY, M.D.

Section on Orthopedic Surgery, The Mayo Clinic

ROCHESTER, MINNESOTA

When adjacent bones are involved in the conditions commonly recognized under the name of "osteoporosis," certain articular changes are of great clinical importance to those interested in orthopedic surgery and physical therapy. Many have written on the subject. The articular changes have been variously classified and different types of treatment have been recommended. That osteoporosis underlies all of these changes is probably true, but that the other tissues about a joint are likewise involved in the process is equally true.

The condition may often go unrecognized because it is insidious and the onset usually is rather slow. The history is somewhat as follows: A patient sprains a joint, such as the knee or ankle. Some pain results and some degree of relief is obtained with rest and fixation. Resumption of activity in a mild way may cause no distress but if the activity is increased just a little the pain may recur. The pain often may be associated with swelling or effusion and the patient indulges in another period of rest. This aggravates the condition because of the prolonged disuse, and further atrophy results. In this way a vicious cycle is established and before long the patient is more or less of an invalid and has a painful swelled joint. If the true underlying condition is not recognized, the disability may last for months or even years.

We are all more or less familiar with the acute "reflex" atrophy of Sudeck. This was described by him, in 1900, as an "active atrophy" secondary to inflammation, but this author was later converted to the idea proposed by Kienböck, namely, that the condition was due to a trophoneurosis set up in a limb, after infection or injury. The trophoneurotic theory of the cause of the condition is probably most widely accepted today. Just exactly what takes place is not well understood, but it is assumed that some local infection or injury causes a reflex disturbance in the "trophic" nerve centers and produces a secondary process of the extremity, characterized by atrophy of bone, swelling, edema, pain and cyanotic discoloration of the affected part. This may come on rather rapidly and result in severe disability for some time. It should be recognized as an entity and treated as such.

What I am attempting to describe here may be associated with a real Sudeck's atrophy in some instances, but in many cases I believe it to be a separate clinical entity. For that reason it must be dealt with in a different manner. Much of the literature on osteoporosis of the painful type deals with Sudeck's atrophy, hence, I may refer to this atrophy from time to time in order to draw a clear picture of the condition. The atrophy of disuse also is well recognized by orthopedic surgeons. It sometimes is called "plaster-of-Paris" disease; it is expected to occur in most cases in which prolonged fixation in a cast is employed. After removal of such a dressing, steps are taken at once to combat the atrophy.

Lovett, in 1912, described post-traumatic painful atrophy of joints accu-

* Read at the Seventeenth Annual Session of the American Congress of Physical Therapy, Chicago, September 15, 1938.

rately, and anyone interested in this subject should read his article. His description is as follows:

> A patient received an injury to the knee, we will say, which results in an acute synovitis. This is treated by fixation until the fluid has disappeared, when massage may or may not be given and the splint discontinued. This treatment is the classical one, and generally accepted, on the whole, as the best. Use is then allowed gradually with the protection of a bandage, massage perhaps being continued. Under these conditions some patients recover wholly in a few weeks, and others do not.
>
> In the latter class the knee continues irritable and painful on use; it feels insecure in walking and may stiffen after sitting. After every extended attempt at use it becomes painful and the patient rests until it feels better. This process goes on week after week or month after month with varying progress, but with no real gain, and the patient, after trying one physician after another, is likely to be advised to wear an elastic knee cap.

On presenting themselves for examination the patients usually complain of a variable amount of pain, which is more or less constant and usually localized in the knee, or whatever joint may be affected. The pain may be more severe at times than at others and may be accompanied by an occasional increase in the size of the joint. On examination one finds, when the patient is standing, an obvious lowering of the level of the patella on the affected side (fig. 1). When the patient is seated with the knees extended there is usually a flabby type of swelling of the knee joint, which occasionally is moderately distended with fluid. Some thickening of the synovial lining of the joint is occasionally noted.

There is atrophy of the quadriceps muscle; the atrophy often is visible and always is evident on palpation. The atrophy at times may be so great that the patient cannot contract the muscle. In cases in which the knee joint has been subjected to prolonged fixation this phenomenon may be rather common; that is, the quadriceps muscle cannot be voluntarily contracted and it may take considerable effort and concentration on the part of the patient to make it contract. There may be a mild elevation of the local temperature. Tenderness on palpation of the joint, particularly along the margins of the joint, is usually noted. Limitation of motion of a varying degree is usually present and pain is produced by forced motion beyond the limit of the voluntary range.

One usually is impressed with the fact that the patients may have a neurosis or at least what one might call neurotic tendencies. It is certainly true that in many cases a definite vasomotor neurosis exists, but in other cases it may be difficult to discover such changes. Usually, as treatment progresses, the neurotic trend may be brought out if the patient is carefully and closely watched.

This condition then may be regarded as a clinical entity, perhaps as a variation of Sudeck's atrophy, although often its onset is slower than that of Sudeck's atrophy, and the symptoms are much less severe. One may say that there are three types of atrophy; all of these may be variations of the same pathologic processes, but they often present a different clinical picture. These are: (1) Sudeck's "reflex" atrophy, (2) post-traumatic painful atrophy of the joints, and (3) atrophy of disuse.

Many joints may be affected by post-traumatic painful atrophy. It is probably most commonly seen in the knee and ankle, although the joints of the upper extremity may be involved, particularly the shoulder and wrist. In some cases it may be noted that involvement of the wrist or ankle is often especially severe; in such cases the condition probably is Sudeck's atrophy.

Differential Diagnosis

The most interesting part of this study is the differential diagnosis. One may say that in many instances the condition is entirely forestalled by early steps to prevent its occurrence. Once the condition is fully established, however, the picture may be confusing. Usually, a diagnosis of tuberculosis of the joint has been made at least once or perhaps more often. Indeed, the clinical picture is not unlikely that of tuberculosis and the differential diagnosis may be difficult. Usually, the most important guide to the diagnosis is the absence of evidence of tuberculous disease in other parts of the body. Diagnostic aspiration, and even biopsy, may be necessary, although I never have had to resort to them. As a rule, the swelling is not so marked in cases of post-traumatic painful atrophy as it is in tuberculous arthritis. In the former condition there is not so much elevation of local temperature, there is little or no free fluid in the joint, and the roentgenograms reveal osteoporosis (fig. 2), either punctate or diffuse, but no actual destruction, hence there is little, if any, change in the contours of the joint. Pain, limitation of motion, and atrophy are about the same in both conditions.

Fig. 1. — Post-traumatic painful atrophy of left knee, showing lower level of left patella and fullness about left knee.

Various types of arthritis may be confused with this condition but, as a rule, except for the specific types, such as tuberculous and gonococcic, arthritis involves more than one joint, while post-traumatic painful atrophy usually is confined to a single joint or at least to one extremity. Recurrent hydrops and infectious synovitis of one joint may occasionally be confused with post-traumatic painful atrophy and indeed the two conditions may be extremely difficult to differentiate (fig 1).

Hysterical persons may have joints which closely simulate those which are the site of post-traumatic, painful atrophy. However, it should be easy to distinguish the joint of actual hysterical paralysis from that of post-traumatic, painful atrophy. Various types of compensation neurosis may be accompanied by post-traumatic, painful atrophy of joints, and in cases in which the two conditions are present, one's diagnostic skill and patience may be tried to the utmost to make a correct diagnosis. In such cases the attitude of the patient is an important factor in determining the true underlying condition.

Fig. 2. — Marked osteoporosis in the case of a woman, aged forty, with post-traumatic painful atrophy of the right knee of eighteen months' duration; *a*, anteroposterior view, and *b*, lateral view.

I have seen some cases in which the presence of various types of paralysis was suspected, particularly those resulting from anterior poliomyelitis and peripheral neuritis, on account of the extreme weakness of the muscles of the joint. Usually careful examination will reveal that in cases of post-traumatic painful atrophy there is no actual paralysis, but simply an extreme degree of weakness.

Pathologic changes rarely have been observed but it was possible to observe these changes in one case in which arthrodesis ultimately was performed at The Mayo Clinic.

Report of Case

A man, aged fifty-two, a railroad agent, came to the clinic on March 28, 1930, because of pain in the left knee. The pain had been present for seven years. He had had prostatitis, but there was no evidence of disease of the prostate gland. There was a history of benign hypertension of moderate degree. In January, 1923, he had injured his left knee when he had fallen on the ice. He had remained in bed for a week after the accident and had walked with crutches for almost six months. In September, 1923, he had been in an automobile accident and his left knee had been injured again. One physician had said that the knee was fractured and another had said that it was sprained. The patient first came to the clinic in April, 1924, because of a flexion deformity of the knee. An osteotomy corrected the deformity. He wore a brace after the operation and was improving until he fell again and "sprained" the knee.

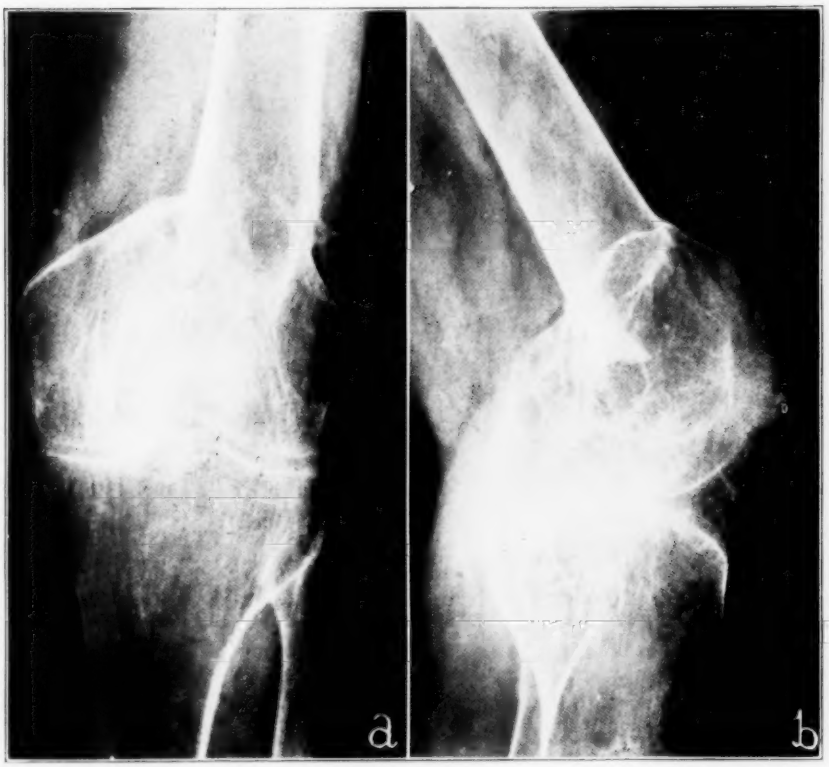


Fig. 3. — Extreme degree of post-traumatic painful atrophy, showing site of previous osteotomy; *a*, antero-posterior view, and *b*, lateral view.

After this accident he used crutches for almost a year. In 1927, he "strained" the knee again and wore a knee cage for some time. The pain in the knee never disappeared entirely after the first accident. When the patient came to the clinic at this time he was wearing a brace and using crutches. Because he had been disabled for such a long time, he desired to have the knee "made stiff."

Examination revealed that the patient was well developed and well nourished. The systolic blood pressure was 160 mm. of mercury and the diastolic pressure was 94 mm. Urinalysis did not reveal any abnormality. The concentration of hemoglobin was 18.7 gm. per 100 c.c. of blood. The Wassermann blood reaction was negative. Roentgenologic examination disclosed an old fracture of the distal third of the left femur. Good union had occurred, but there was some atrophy of the bone (fig. 3). The range of motion in the left knee was about 20 degrees and movement of the joint caused pain. There was no evidence of swelling, itching, or local heat. There was noticeable atrophy of the muscles of the thigh. Deep pressure about the joint elicited some tenderness.

A resection of the left knee was performed. The patient made an excellent recovery. He has been at the clinic several times since this operation; the ankylosis has been satisfactory and the patient has a useful limb.

Examination of the portion of the joint that was removed disclosed an extreme degree of atrophy of the bone. The joint was dry. The synovial membrane was only slightly thickened but a definite panus-like membrane covered a portion of the surface of the joint. The cartilage was decidedly thinner than normal; along the margins of the articular surface the cartilage was so thin that it was almost transparent. Microscopic examination disclosed an extreme degree of atrophy of the trabeculae of the bone, absence of all the marrow elements, and extreme thinning of the cartilage (fig. 4). The remaining cells were small and devitalized. In the sections examined, the synovial membrane appeared virtually normal.

Fig. 4. — Section through cartilage and bone, showing marked thinning of the articular cartilage and extreme atrophy of trabeculae.

In this case it was possible to observe the changes that had occurred in the joint. The joint was dry in this case, but fluid may be present. In certain stages of the condition there may be a definite thickening of the synovial membrane. This probably is the result of edema and vascular engorgement.

Prognosis

In most of these cases the outlook for ultimate relief is excellent. In many cases spontaneous healing no doubt takes place without any particular treatment. This is especially true when the patients have been made to realize that they do not have a serious disease, such as tuberculosis, and that use is after all the most important factor in recovery.

Treatment

Unfortunately, in many of these cases the condition has become so far advanced that such simple measures as advice to use the affected joint are of no avail. The first thing that should be done is to convince the patient that he does not have a tuberculous joint or something equally serious that requires complete rest. Physical therapy may be commenced, and whether or not one uses diathermy or various forms of radiant heat depends in most instances on the effect these measures may have on the patient. If they are soothing and do not cause pain, they may be employed.

Massage is usually of considerable benefit; at first it must be very light but heavier and more vigorous types may be used later. Of all the procedures, it seems to me that active exercises are the most important. Such exercises must be commenced very carefully and gradually made more strenuous as the patient is able to tolerate them.

It has been my experience that, particularly in the early stages of treatment of these conditions, a frequent setback may be expected. By this I mean that the patient may overdo the exercises a bit and severe pain often may return. One must slow down on the treatment, but the important thing is to keep the patient actively under care and not allow him to give up and go back to a cast or splinting, as he often may desire to do. As confidence is gradually instilled and motion is restored to the joint, weight-bearing may be commenced. This must often be done with crutches at first, but later a cane may suffice. When these steps are taken, care must be taken that the foot is properly shod. Bandaging of the leg and knee is often necessary to prevent a disturbing swelling. One should avoid weight-bearing where extreme osteoporosis is demonstrated in the roentgenogram, but with the aid of crutches this factor usually does not cause serious interference if the weight is not heavy. Thus, a gradual resumption of activity is accomplished and the patient gains confidence and spontaneously assumes more activity. Complete restoration of function may require many months, but the patient often can be made to assume more or less normal activity within three months.

Sympathectomy has been recommended in cases of Sudeck's atrophy by various writers. Heyman, Leriche and Fontaine, Fontaine and Herrmann, and Herrmann reported cases in which the results of this operation were very favorable. However, others have reported failures with the same procedure in cases of Sudeck's atrophy, and it does not yet seem to have established itself as the method of choice in such cases. It seems even less important in cases of post-traumatic painful atrophy of joints, as all the patients will recover if properly supervised conservative measures are utilized.

One other thing which I recommend is some form of calcium therapy, either in the form of a high calcium diet or the addition of calcium in the form of tribasic calcium phosphate and some form of vitamin D. This is not the time or place to argue the merits of calcium and vitamin D in such cases. It has been our custom at the clinic to use these preparations and our clinical observations lead us to believe that they are worth while.

Conclusions

1. Post-traumatic painful atrophy of joints is a condition that is related to, but differs from Sudeck's atrophy and the atrophy of disuse.
2. The treatment consists of graduated exercises together with other appropriate physical therapeutic measures.
3. The use of calcium and vitamin D is recommended.

Bibliography

1. Fontaine, René, and Herrmann, L. G.: Post-Traumatic Painful Osteoporosis, Ann. Surg. **97**:26 (Jan.) 1933.

2. Herrmann, L. G.: The Diagnosis and Treatment of Post-Traumatic Painful Osteoporosis, Internat. J. M. & Surg. **47**:510, 517 (Dec.) 1934.

3. Heyman, C. H.: Osteoporosis Relieved by Sympathectomy. Report of Case, J. A. M. A. **82**:1333 (April 26) 1924.

4. Leriche, R., and Fontaine, R.: Des ostéoporoses douloureuses post-tramatiques, Presse méd. **1**:617 (May 7) 1930.

5. Lovett, R. W.: The Atrophy of Muscle and Bone Resulting from Joint Disease, Injury and Fixation, J. A. M. A. **58**:1576 (May 25) 1912.

6. Sudeck, P.: Ueber die acute entzündliche Knochenatrophie, Arch. f. klin. Chir. **62**:147, 1900.

ELECTRICAL POTENTIAL DISTRIBUTION IN PHANTOMS AT LOW AND HIGH FREQUENCIES *

A. KOLIN, Ph.D.,

and

F. T. WOODBURY, M.D.

NEW YORK

Attempts to obtain an idea of the distribution of the high frequency current in parts of the body when using electrodes of various types and sizes and diversely placed, have been made by a number of investigators since Nagelschmidt (1909) initiated this problem in medical diathermy. Most of the information has been obtained from studies of the temperature distribution in phantoms heated by a current. The temperature distribution was arrived at either by direct thermometry or a crude idea was obtained by some who used various chemicals which changed their color or transparency when heated.

The method of determining current distribution within phantoms by measuring the heating effects in different locations has several drawbacks. The first is that successive determinations of temperature at many points, after the heating procedure, take so long that it is practically impossible to obtain a true picture of the temperature at any given moment in different parts owing to its conductive equalization between the diverse regions. A simultaneous insertion of a great number of thermometers might appreciably affect the current flow by breaking up the continuity of the medium being tested.

Another drawback to estimating the current distribution by the indirect heating effect is that, owing to the temperature coefficient of electrical conductivity of the medium, the electrical conductivity would be increased in the heated regions and thus distort the initial distribution of the current. If a temperature distribution could be successfully plotted in a phantom resembling the human body, it would not even approximate the distribution actually obtained in the living body since in the latter it is greatly modified by the circulating blood.

It appeared to us therefore that direct electrical studies of the current distribution would be of more value since it would not be affected by the circulation and the results obtained on a dead model would remain valid for the living body. The purely electrical method for the determination of current distribution here described, permits the use of currents weak enough to avoid appreciable heating. It was first described by Fortescue and Farnsworth and further developed and applied for investigation of special problems in electrical engineering by Estorff and others.

Experimental Method

Just as heat flows from points of a higher to those of a lower temperature, so electrical currents flow from points of a higher to those of a lower electrical potential. There will be no heat transfer between points of the same temperature and similarly no current will flow between points of the

* From the Laboratories and Physical Therapy Department, Mount Sinai Hospital, New York City.

same electrical potential. We shall refer to such points as equipotential points. As we shall see under certain conditions, such points can be situated along a curved or straight line or fill a surface in space. We shall refer to such lines or surfaces connecting all equipotential points corresponding to any fixed potential as the equipotential lines or surfaces.

The fact that no current flows between equipotential points can be used for the determination of equipotential lines and surfaces in the following way. Suppose we have a sheet of conducting material and suppose that we have a direct current passing through it between the two electrodes E_1 and E_2, in figure 1. The potential of E_1 may be V and that of E_2 be 0. A potentiometer (tapped resistance) connected with E_1 and E_2 allows tapping any potential value between V and 0. The tap T is connected through a galvanometer to an exploring electrode, Ex, which is made to slide over the surface. Points at which no current flows through the galvanometer between the exploring electrode and the potentiometer tap are equipotential points. Thus these points can be easily located and connected to give the equipotential lines. We may subdivide our potentiometer into any number of equal parts and then plot the equipotential lines corresponding to these various potentiometer divisions (fig. 2).

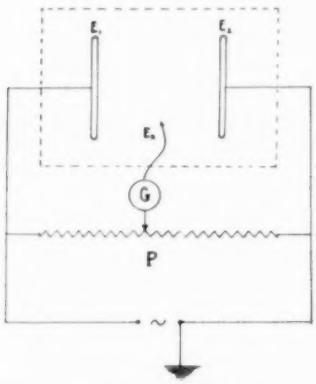


Fig. 1. — Circuit used for determination of equipotential lines. E_1 and E_2 represent electrodes; Ex represents the exploring electrode; G represents the Null detector; P represents the potentiometer.

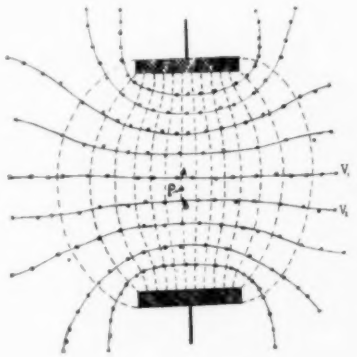


Fig. 2. — Equipotential lines (solid lines) and lines of current (broken lines) as determined in a 2-dimensional phantom of moist blotting paper with 2 parallel plate electrodes. (A 60 cycle alternating current was used.) The coincidence of equipotential lines obtained with a potential difference of 110 volts or 25 volts between electrodes is demonstrated. The crosses x, indicate points obtained with 110 volts, while the circles o, indicate points obtained with 25 volts. A, B and P refer to description in the text, q. v.

Figure 2 was plotted with a 60 cycle alternating current rather than a direct current as a source of potential, hence an alternating current flows between the potentiometer tap and the exploring electrode so long as their potential difference is not zero. The zero point in an alternating current can be detected by insertion of head phones instead of a galvanometer, and it is particularly convenient to use the amplifier of a radio receiver for detection of that point. Similarly pictures of equipotential lines were obtained with high frequency alternating currents from a conventional spark-gap diathermy apparatus, using a rectifier and galvanometer as the null detector (fig. 3).

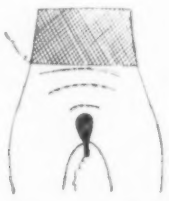


Fig. 3. — Shows the coincidence of equipotential lines as determined with H. F. currents from a conventional diathermy machine and low frequency 60 cycle alternating house current. The solid lines represent the 60 cycle current and the broken lines represent the high frequency current. The cross hatched areas represent the electrodes.

Figure 3 shows the coincidence of the equipotential lines due to low frequency (60 cycle A. C.), and those due to high frequency (conventional diathermy) current determined in a three-dimensional phantom (described later). This close coincidence justifies the use of a 60 cycle alternating current to obtain information as to distribution of potential in homogeneous phantoms traversed by high frequency currents. Figure 2 shows that our potential distribution does not exhibit any significant changes while the voltage across the electrodes is varied over a wide range.

The knowledge of the equipotential lines gives an idea of the relative rate of heat production in different parts of the phantoms and also enables us to trace the path of the electrical currents, because these flow so as to intersect the lines or surfaces of equipotential invariably at right angles. Hence, if we start to draw the path of a current emerging from one of the electrodes, the direction it will follow will be determined throughout its course by the requirement that it must be perpendicular to all equipotential lines which it crosses (see broken lines in fig. 2).

The heat production at any spot of an homogeneous phantom is proportional to the square of the potential gradient. This quantity is defined as the potential drop per unit distance in the direction of the greatest potential variation. If our network of equipotential lines were so dense that the portion of a line of current between them could be considered as a straight line, we could approximately express the potential gradient at P (fig. 2) as the potential difference of two equipotential lines V_1 and V_2 divided by the length of the line of current AB lying between them. Hence the relative distance of the equipotential lines in our distribution pictures convey an idea about the relative rate of heat production in the various regions.

Method With Three-Dimensional Phantom

A study of the potential distribution in vaginal diathermy treatment was made on a plaster cast of a female subject extending from the lower costal border to just above the knees. This cast was removed by a horizontal incision at a high level. By closing the ends at thighs and waist a container was created which was made water-tight by asphalt paint, within and without. When filled with tap water or saline this container furnished a homogeneous phantom of the female pelvic region.

A vaginal electrode was inserted through an opening simulating the vaginal introitus and a belt electrode of the usual Crookes metal was placed inside the phantom at the waist level and in close contact with the inner walls. (Thigh electrodes were applied in a similar manner [fig. 4]). Although this torso is incomplete it represents a fair approximation to reality.

Figure 4 shows the actual arrangement used for determining the equipotential lines. PH is the phantom of the pelvis mentioned above. The

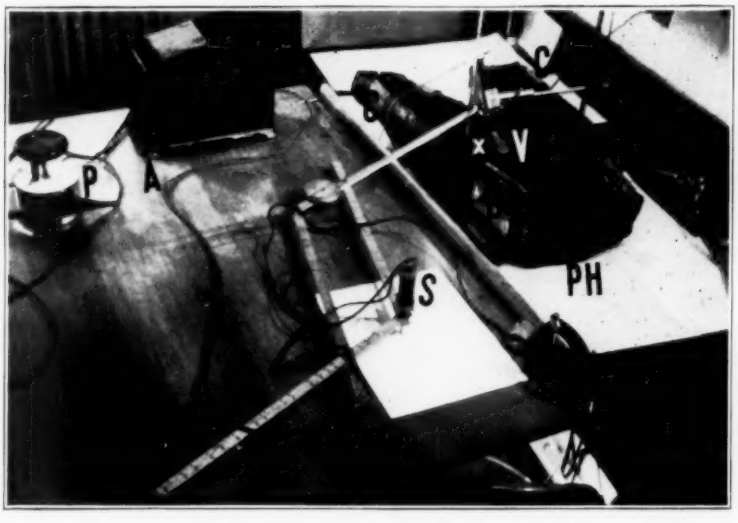


Fig. 4. — Photograph shows phantom of a female pelvis, PH, filled with tap water, or saline, as well as the electrical circuit used for determining the equipotential lines at varying depths. B represents a belt electrode placed inside phantom in contact with contours. C represents cuff electrode placed inside the thigh of phantom, similarly to B. V is the vaginal electrode inserted through an orifice in the phantom and supported by a stand. It is immersed in the liquid. X is the exploring electrode attached to the long arm of a pantograph. Only the lower tip is uninsulated. It can be lowered to various depths. S is a solenoid with a plunger attached to the short arm of the pantograph. Whenever an equipotential point is located by X, as signalled by the null detector, the plunger can be made to mark a dot on the recording paper by closing the electrical circuit of S. A is an amplifier with loud speaker which acts as a null detector. P is the potentiometer.

alternating current passes between the vaginal electrode V and the belt electrode B. The cuff electrodes C were either connected with B or removed. The exploring electrode is attached to the long arm of the pantograph P in place of the usual tracer. It is insulated except at the extreme tip and can be moved up and down or horizontally at any level. At S the pencil of the pantograph is replaced by a solenoid with an iron plunger which, whenever an equipotential point is located by the exploring electrode, can be made to stamp a dot on the recording paper.

An insulation transformer T is used to supply voltage to the potentiometer and phantom electrodes if an A. C. line-fed amplifier serves as the null detector, but if head phones are used, T is unnecessary. The potentiometer P_2 with 130 divisions is connected to the two electrodes V and B. Its variable tap, as well as the exploring electrode, is connected with the input of the radio amplifier A.

After adjusting the exploring electrode at the desired level the position of the variable tap was set and the corresponding equipotential line was ascertained. A series of such lines was similarly obtained at different potentiometer settings. The exploring electrode was then adjusted at another level and the same series of potentiometer settings were repeated. In this way an idea was gained about the spatial distribution of the electrical potential in a three-dimensional phantom.

Figure 5 shows a typical series of equipotential lines at different levels below the water surface. These lines actually represent the intersections of the equipotential surfaces with the horizontal planes at different levels.

Figure 6 corresponds with figure 5a except that the phantom contains saline solution.

Figure 7 shows the effect of the presence of the pelvic bones on the po-

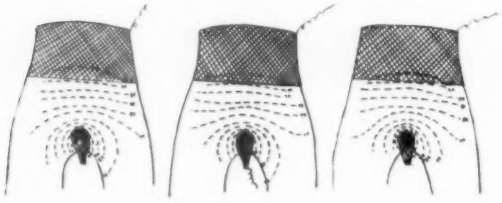


Fig. 5, *a*, *b* and *c*. — These diagrams represent the intersection of equipotential surfaces with the horizontal planes, a, at water level, b, at 2 cm. and c, at 4 cm. below water level. The cross hatched areas are the projection of the vaginal and belt electrodes. The numbers at the equipotential lines refer to corresponding potentiometer settings. Tap water phantom. 60 cycle alternating current.

tential distribution. The lines were interrupted wherever the pelvic bone interfered with the movement of the exploring electrode.

In figure 8 is shown the deformation of the equipotential lines occasioned by the connection of cuff electrodes (around the thighs) with the belt electrode.

Figure 9 shows the effect of an auxiliary electrode at the surface of the phantom when connected with the belt electrode. Its effect will be seen to extend far downward below the surface. The equipotential lines are crowded in its neighborhood as compared with other regions of the phantom, which means that the potential gradient in that vicinity is increased and heat production very much augmented.

High Frequency Treatment in the Condenser Field

The method described above may also be adapted to illustrate the distribution of high frequency currents in condenser fields. It can be shown mathematically that the path of the electrical field lines in a configuration of media of different dielectric constants is the same as that of current lines in a corresponding electrolyte model composed of layers having different electrical conductivity. The ratios of the conductivity in the electrolyte model should be equal to the corresponding ratios of the dielectric constants in the condenser field.

A two dimensional model was accordingly made which is represented in figure 10, where S represents in cross section a cylindrical piece of tissue placed between two condensers P_1 and P_2. A large piece of blotting paper,

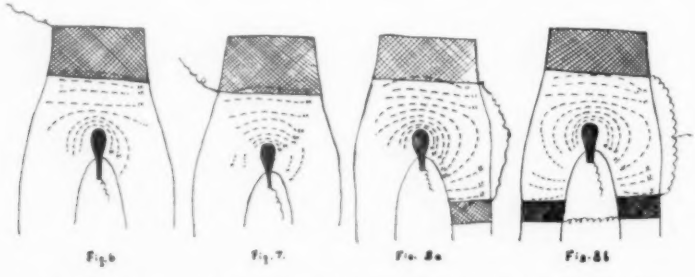


Fig. 6. — Corresponds with figure 5-a, but the phantom is saline solution.
Fig. 7. — Corresponds with figure 6 but with the pelvic bone in place (not shown).
Fig. 8, *a* and *b*. — Shows deformation of the field when one thigh cuff-electrode is connected with the belt electrode. Depth, 2 cm. below surface. Tap water phantom. 60 cycle alternating current; *b*, shows deformation of potential distribution when two thigh cuff-electrodes are connected with belt electrode. Depth 2 cm. below surface. Tap water phantom. 60 cycle alternating current.

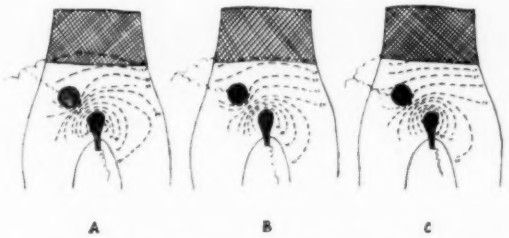


Fig. 9. — These diagrams show the effect on potential distribution at different levels, (*A*, at water surface; *B*, at 2 cm. depth, and *C*, at 4 centimeters depth) of a disc electrode at surface level placed between the belt and vaginal electrodes and connected with the belt electrode. The greatly increased concentration of equipotential lines in the interspace between the disc and the vaginal electrode implies a great increase in heat production in that region. Tap water phantom. 60 cycle alternating current.

A. B. C. D. is cut and soaked in tap water.* While another piece of blotting paper S is cut to represent the treated object, in cross section, and soaked in saline solution* of such concentration that the ratio of its conductivity to that of the tap water bears the same ratio as that between the dielectric constant of human tissue and that of air. S is placed upon the blotting paper square between the two electrodes as shown (P_1 and P_2). The lines of equipotential, and if desired, the lines of current are determined in the manner shown above, using a 60-cycle alternating current.

Figure 10 very clearly shows the phenomenon of refraction of the electrical field at the interface between air and tissue. The lines of current and equipotential both change their direction abruptly as they pass from one medium to another. It will be noted that the lines of current are being concentrated by the object S in a way similar to the concentration of the magnetic lines of force by an iron object. The potential difference between each two equipotential lines is equal to 1/10 of the potential difference between P_1 and P_2. The dotted line L forms an exception as it is an additional auxiliary line introduced midway between two equipotential lines to facilitate drawing the lines of current.

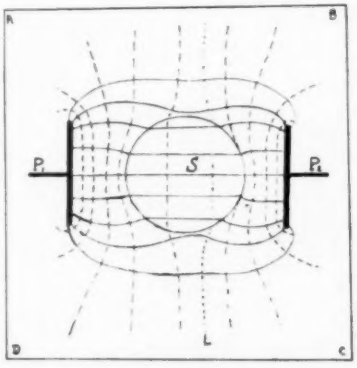


Fig. 10. — This shows the distribution of potential and currents in a dielectric cylinder (shown in cross section as a disc) when placed in a high frequency field. A, B, C, D, mark limits of blotting paper soaked in tap water which represents air and is the cylinder represented by a disc of blotting paper soaked in saline solution which represents tissue. P_1 and P_2 are plate electrodes.

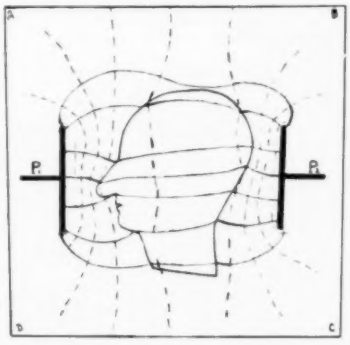


Fig. 11. — Shows in cross section a human head placed in a high frequency field as S in figure 10. The equipotential lines are shown in broken line and the paths of the high frequency current are shown in solid lines.

* Agar is added to tap water and saline solution to reduce the rate of evaporation and increase the viscosity.

The greatly reduced density of the equipotential lines in S indicates a lower potential gradient which would tend to reduce the current through S; but this effect is compensated by the greater electrical conductivity of S which favors the passage of the current. This is the reason why the lines of current do not spread out in S in proportion to the separation of the equipotential lines, P.

Figure 11 shows the cross section of a human head placed in the condenser field. Besides the effects in figure 10, we observe the concentration of the lines of current at the protrusions of the nose. The consequence of this phenomenon is the well known clinical effect of increased generation of heat in such protruding parts.

It is obvious that many other arrangements such as are encountered in practice may be analyzed in this manner. Although no quantitative results could be expected from this simplified scheme, it is adequate to give a qualitative idea* which is by all means preferable to the usual guesswork so often encountered in the literature.

Bibliography

1. Fortescue, C. L., and Farnsworth, S. W.: Proc. A. I. E. E. **32**:757, 1913.
2. Estorff, W.: E. T. Z. **37**:61, 1916.

* The writers desire here to express appreciation and indebtedness to Wm. Bierman, M.D., Director of the Department of Physical Therapy, Mount Sinai Hospital, for valuable suggestions and encouragement in this work.

GALVANISM IN THE TREATMENT OF BRONCHIAL STRICTURES *

JOHN D. KERNAN, M.D.

and

DANIEL C. BAKER, JR., M.D.

NEW YORK

The development of the bronchoscope for the direct examination of the tracheobronchial tree has greatly added to the study and treatment of pulmonary diseases. Its field of usefulness has increased considerably since Killian[1] in 1897, first employed it to remove a foreign body from the bronchus. Killian demonstrated the feasibility of bronchoscopy, and from that period there has been considerable progress in this specialty due to the perfection of instruments and improvement of technic. The bronchoscope has proved its value in the diagnosis and treatment of many pulmonary diseases.[2] In more recent years bronchoscopy as an aid in the treatment of bronchial tuberculosis has received wide attention. Many problems requiring solution are confronting the bronchoscopist who attempts to treat tuberculous lesions of the bronchus. One of these problems has been the management of the strictures which develop as a result of the disease. The elucidation of this problem has occupied the attention of the authors.

This article includes a discussion of the etiology and treatment of bronchial stenosis; the effect of bronchial stenosis on pulmonary tuberculosis; the general use of the galvanic current for the treatment of strictures; the application of this current for the treatment of bronchial strictures; and a summary of experiments carried out on dogs.

Etiologic Factors

Depending on the site of the etiologic factor with relation to the wall of the involved bronchus, stenoses may be divided into three groups: extramural, mural, and intramural.[3] The extramural group of stenoses may be caused by mediastinal tumors, lymph nodes, or aneurysms, which compress the walls of the bronchus from without. The mural group includes inflammatory processes, tuberculosis, carcinoma, syphilis, and any process which causes swelling, shrinkage or distortion of the bronchial wall. The intramural group includes foreign bodies or occasionally thick tenacious secretions.

We are here concerned with the mural group of bronchial stenosis, in which the disease is present in the bronchial wall. Syphilitic lesions have been described in the literature as giving rise to webs and membrane like scars after healing. Rhinoscleroma is reported as causing a thick sclerotic and non-ulcerating type of bronchial narrowing which on healing ends in excessively deforming scars. Leprosy may produce strictures. Bronchogenic carcinoma is a common cause of this form of stenosis. The lesion begins in the wall of one of the larger bronchi and eventually occludes the lumen. There are also benign neoplasms of the bronchi which may cause obstruction of the air passages by projecting into the lumen.

Tuberculosis can cause bronchial obstruction through external pressure of infected lymph nodes or by involvement of the bronchial mucosa itself.

* From the Department of Otolaryngology, Columbia University, College of Physicians and Surgeons.

Eloesser[4] states that tuberculosis of the bronchi was found in 4 per cent of the autopsies on patients with ulcerative pulmonary tuberculosis. This figure is probably larger, because the diagnosis of bronchial tuberculosis is more frequently made today, during life, by bronchoscopy.

Kernan[5] states that tuberculosis attacks the bronchus in a number of ways. This author asserts that —

> In an active open case in which sputum contains numerous tubercle bacilli, shallow ulcerations may appear in the mucous membrane of the trachea or bronchi. These are thought to be produced by implantation. Such ulcerations are at times the cause of a persistently positive sputum continuing to discharge tubercle bacilli even after the primary lesion has healed. At times the outer layers of a bronchus will be attacked by tuberculosis through the lymphatics. The disease spreads inward perhaps involving the whole wall, attacking the cartilage and changing the bronchus to a mass of dense fibrous tissue with a small fistula running through it, representing the almost destroyed lumen.
>
> Another form of attack is that through the mucous glands which lie in the outer layer of the wall of the bronchus. The disease spreads through the duct and appears in the interior of the bronchus as a spreading ulceration.
>
> Closure of a bronchus can also be caused by pressure made outside by a large tuberculous node. Such a gland will at times break down and ulcerate into the lumen of the bronchus. The final form which it may take is a widespread involvement of the mucous membrane. This later may become so thickened that its swelling almost closes the lumen of the bronchus. In some of these cases there will be no ulceration, only a thick congested mucous membrane lining the very narrow tube.
>
> There is a great tendency for the body to heal tuberculosis. When this happens the tuberculous granulation tissue is replaced by dense scar tissue. Thus one of the sequelae of tuberculosis of the bronchi is stricture from contraction of the scar tissue, which may be so extreme as to completely close the main bronchus.

Lung Changes Distal to Bronchial Stenosis

The condition of the lung distal to a bronchial obstruction depends upon the degree of obstruction. A ball valve mechanism occurs in many cases of incomplete obstruction. The normal bronchus is seen to become longer and wider on inspiration and shorter and narrower on expiration. Thus air is likely to be inspired into the lung distal to the incomplete obstruction, but encounters difficulty because of the changes in diameter of the bronchus during inspiration and expiration. The involved area is said to be in a state of obstructive emphysema, and the condition can be recognized clinically.

When obstruction is complete, no air enters the lung distal to the obstruction. The residual air is absorbed by the circulating blood, the alveoli become atelectatic and the bronchi are filled with a thick jelly-like mucus.

In many instances the lung distal to an obstruction becomes infected with pyogenic organisms. Adequate drainage of the infected area cannot take place because of the obstruction; the lung becomes damaged and bronchiectasis, pulmonary abscess, necrosis, and fibrosis may be the result. This is an important consideration which will be discussed when the treatment of bronchial stenosis is considered.

The effect of bronchial stenosis on cavities of pulmonary tuberculosis has been studied by Coryllos[6] and Eloesser,[7] who have shown that the development of spherical cavities in pulmonary tuberculosis are due to changes in the bronchi causing a ball valve action in the area involved. Air can enter the lung distal to the obstruction on inspiration, but remains trapped on expiration. This causes positive pressure in the cavity and leads to ballooning out of the cavity, making it spherical in outline. Cavities have been "needled" and the pressure found to be increased.

Coryllos and Eloesser differ as to whether spherical cavities can exist in cases where a bronchus is completely closed. Coryllos believes that closure of a bronchus draining a tuberculous cavity results in atelectasis,

absorption of the air in the cavity, and final cure. Eloesser believes that it is because of the complete obstruction that cavities will not close. Experiments of Adams and Vorwald[8] show that tuberculosis runs a very much milder course when obstructive atelectasis is produced in the infected lobes of a dog's lung. This is due to the fact that tubercle bacilli cannot derive the energy necessary for the continuation of life from anaerobic processes.[9]

Treatment of Bronchial Stenosis

The treatment of stenosis of the bronchi is that of the main underlying disease. Syphilis should be treated with the mercurials, arsenicals, and bismuth. Iodides are contraindicated as they tend to cause an increase in cough and expectoration. Benign endobronchial tumors may be removed by bronchoscopy. Carcinoma if favorably located should be removed by lobectomy or pneumonectomy. X-ray therapy should be given in inoperable cases.

The treatment of tuberculosis of the bronchus varies according to the existing lesion. If the lesion is active, the bronchus should be put at rest by pneumothorax.[10] The tuberculous ulcerations of the bronchi are treated by electrocoagulation, silver nitrate and the mercury vapor lamp. The latter is the best form of treatment, as it causes less scar tissue to develop when healing occurs.

If a tuberculous cavity is distal to the bronchial stricture, the question arises as to what method should be employed for the treatment of the stricture. The question is raised, would not many cases in which the lung were clear of secondary infection be benefited by complete closure of the bronchus? This would be in agreement with the principles of Coryllos, who believes that a tuberculous cavity will disappear and the lesion will heal if the draining bronchus is completely closed. Eloesser takes the opposite view, namely, that the reason cavities do not close is because the bronchus is completely stenosed. This problem remains to be answered. Nevertheless, since the majority of strictures of the bronchi seen in clinical work are the result of a tuberculous infection, one has to consider what should be done to the strictured area. Should an attempt be made to open the stricture, or should it be closed?

If there is a secondary infection or a pyogenic infection distal to a bronchial stricture, it is important that it be dilated. Adams has shown that pyogenic infections do not do well in the presence of stenosis. The purulent secretions do not drain out, and symptoms of retention result. There is also a great deal of damage done to the lung with the development of bronchiectasis and necrosis of the involved area. The lung supplied by the bronchus becomes drowned in secretions. This is a dangerous condition.

Thus, given a case of tuberculosis with secondary infection, the problem is primarily to get rid of the infection, and this is best accomplished by dilation of the stenosed bronchus to allow drainage to take place.

The experiments we conducted show that it is a long and difficult procedure to attempt either the dilation or the closure of a bronchus.

The most widely used method for dilating strictures of the bronchi is that of passing bougies of increasing sizes at weekly intervals. Most men agree with Eloesser that this is a tedious and wearisome procedure. The results are not very satisfactory because the stricture will not stay open. In order to find a better method for dilating strictures so that they would remain open, a procedure in use for several years in the treatment of strictures elsewhere in the body was employed for bronchial strictures.

The Galvanic Current in the Treatment of Strictures

For therapeutic purposes there are three main forms of the employment of the galvanic current; medical galvanism in the form of water baths or moist pads; electrophoresis or medical ionization; and surgical galvanism which consists of the electrolytic destruction of tissues. The work presented in this paper deals with surgical galvanism or electrolysis.

The physical, chemical and physiologic effects of the galvanic current on the tissues of the body are described in detail by Kovács[11] and Sampson.[12]

The galvanic current is applied according to polarity. The electrolytic effect of the current upon a tissue will depend upon which pole of the galvanic apparatus is connected to the active electrode.

Kovács has compared the human body to a bag of skin containing a solution of sodium chloride. When the molecules of sodium chloride dissolve in water they dissociate into sodium ions bearing a positive charge and chlorine ions bearing a negative charge. The flow of current through the salt solution causes these ions to move in a definite direction. The positive sodium ions migrate to the negative pole and the chlorine ions move to the positive pole. The ions lose their charge at the poles and become atoms.

The electrolytic effects of the negative pole on the tissues is composed mainly of two factors. The mechanical action of the nascent hydrogen, which Althaus[13] described as forcing itself as innumerable bubbles between the structural elements of the tissues and driving the tissue fibers mechanically asunder; and the formation of caustic sodium hydroxide from the action of the sodium atoms on water, which has a liquifying and softening action on the tissues. The negative pole has an alkaline reaction. The hydrogen and the caustic sodium hydroxide do not act on the metal electrode.

At the positive pole there is an acid reaction, the chlorine ions become atoms and react with water to form hydrochloric acid and oxygen. The metal electrode at the positive pole may be acted upon, becoming oxidized and chlorinated to form a metallic salt. The tissues about the positive pole become hardened; the electrode sticks to the tissues and is withdrawn with great difficulty. The effects produced at the positive pole are germicidal, and a copper electrode employed in this manner has been of definite value in the treatment of chronic endocervitis.

The polar effects take place only under the electrodes. The smaller the electrode the greater will be the action of the current on the area to be treated. The same amount of current passing through a larger area may have no appreciable effect. This can be summed up by saying that the most important factor in the action of a current on a given area is its density. There is no known measure of current density, but the number of milliamperes per given unit of area of electrode will give an accurate measure of the density beneath the electrode. It has been estimated that skin comfortably tolerates 1 to 2 milliamperes of current for each square inch. Mucous membranes tolerate a larger density, because of the absence of the insulating horny layer and their greater vascularity.

Polar Effects of the Galvanic Current on Strictures

In order to dilate a stricture it is important that the electrode should be connected to the negative pole of a galvanic apparatus. The effects of the negative pole consist of the formation of caustic alkali and free hydrogen, and softening of the scar tissue by electrolysis. The alkali has a softening action on the tissue, and after treatment the electrode can be turned about freely in the strictured area. This is the desired result.

The treatment of strictures by this method has been condemned by some clinicians. Sampson who has had a wide experience, attributes their failure to a lack of consideration of the current density. He states that if the current density at the negative pole is too great, there will be an irritating factor to consider. He believes that just enough galvanism should be employed to act on the inner surface of the stricture, and not enough to irritate the surrounding tissues which would result in the subsequent formation of hard fibrotic tissue outside the stricture. If too great a current is used the effect is that of taking out a little scar tissue in the center and adding a greater amount outside. Sampson has worked out a table showing the number of milliamperes to be used for various size electrodes in the treatment of strictures.

It is of utmost importance that the negative pole be used if strictures are to be dilated. Negative galvanism has been used for many years by various clinicians for the treatment of strictures of the urethra, esophagus, and rectum, and for the dilation of congenital stenosis of the cervix. Althaus as far back as 1870, employed the negative electrode for securing dilation of strictures. Uthoff[14] has recently described a technic for dilating strictures of the ureter by negative galvanism. Thus, there is a definite clinical background to justify its employment in the treatment of bronchial strictures.

Jones[15] mentions the use of the positive pole of a galvanic apparatus for the treatment of sinus tracts. He refers in his book to the work of Deve, of Rheims, who treated a sinus tract of the axilla by using a copper electrode. The tract closed after seven applications. Billikin is also mentioned by Jones as having cured two cases of rectal fistula by means of a zinc electrode connected to the positive pole. The local germicidal effect of the metal at the positive pole and the hardening of the tissues and their subsequent contraction are the principles upon which the method depends. It would appear that positive galvanism with a metal electrode might be of value in closing bronchial strictures. The latter has been tried in the experiments to be reported, with questionable success.

Experiments on Dogs

In order to determine the effect of the galvanic current on bronchial strictures, it was necessary first to produce the stricture. Adam's[16] method of closing bronchi was used for the production of bronchial strictures. His method consists of the application of a 35 per cent solution of silver nitrate by means of a piece of cotton on a wire applied directly through the bronchoscope to the bronchial mucosa. Adams produced complete occlusion of a bronchus in ten days to two weeks. In our experimental work it was necessary to apply the silver nitrate on several occasions before producing a stricture. This observation is not in agreement with the work of Adams. Wood[17] was also unable to verify the work of Adams. It was found that suitable bronchial strictures could be produced by this method, but not complete occlusion.

An attempt was made on three occasions to produce tuberculosis of the bronchus in dogs, with the thought that if an active lesion of the bronchus were created, a tuberculous stricture might subsequently develop. The method consisted of first sensitizing a dog by the injection of the bacilli of Calmette and Guérin (B.C.G.) and later injecting an active strain of tubercle bacilli directly into the bronchial wall. The results were disappointing; it was impossible to produce bronchial tuberculosis in this manner.

The experiments were carried out on five dogs. The dogs were anesthetized by injecting a solution of nembutal intravenously, and all of the bronchial work was performed through a bronchoscope. There were four strictures produced by

the method of Adams. A sufficient length of time was allowed to elapse in order to make certain the strictures were permanent, before treatment was instituted. In one instance pulmonary suppuration occurred distal to the stricture; this subsequently disappeared after the stricture was dilated.

At first all four strictures were treated with negative galvanism. Specially constructed copper tips were used in the treatment of the strictures. The active electrode consisted of these small copper tips of different sizes and shapes (fig. 1), which were fastened to a long thin insulated conductor by means of a

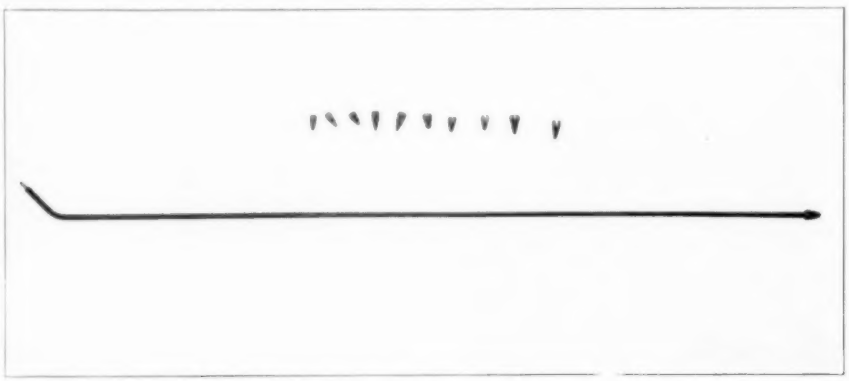


Fig. 1. — The illustration shows the long insulated conductor and various size copper tips (designed by Dr. J. D. Kernan). The copper tips can be screwed to the conductor and then passed through the bronchoscope to serve as the active electrode.

screw thread mechanism. The size of the electrode employed was determined by the size of the stricture. A size large enough to engage the stricture on all sides was selected, and connected to the negative pole of the galvanic apparatus. A covered zinc plate about 5 inches in diameter was moistened with normal saline solution and applied to a shaven area in the lumbar region. The zinc plate was then connected to the positive pole and served as the inactive electrode. The copper tipped electrode was then passed through the bronchoscope into the bronchial stricture and a current of 3 milliamperes was allowed to flow for two minutes. In every instance the stricture could be seen to dilate through the bronchoscope. The region about the copper tip could be seen to liquefy and a whitish frothy fluid formed. This was interpreted as liquefaction of the scar tissue, with the formation of sodium hydroxide and hydrogen gas. At the end of the treatment the copper tip could be moved freely in the strictured area and the bronchus distal to the stricture could be seen. This treatment was usually performed at weekly intervals until the bronchial stricture was dilated enough to carry on its function. At this part of the experiment the treatment was stopped to determine whether the stricture would reform. In one instance, there was a gradual reforming of the stricture, but it did not reach the degree of narrowing that was present before treatment was instituted.

Having secured the same effect of dilatation by using the negative pole of the galvanic apparatus for the active electrode on all four strictures, a larger amount of current was applied to one of the strictures, using the negative pole. This resulted in complete closure of the bronchus and atelectasis of the lung distal to the stenosis. A large amount of current was then applied to another one of the four strictures, the positive pole as the active electrode; the result obtained was also complete closure of the bronchus and atelectasis of the distal lung. The large amounts of current referred to ranged between 10 and 15 milliamperes flowing for two minutes. It was observed that with the greater flow of current, involuntary movement of the dog's body would occasionally develop.

In no instance was there any untoward reaction due to the current. In between treatments the animal appeared to be quite healthy.

Discussion

A method of using the galvanic current for the treatment of bronchial strictures has been described. The amount of current used was the determining factor as to whether the effect would be one of dilatation or more stenosis. Either effect has a definite place in the treatment of bronchial strictures resulting from tuberculosis. Whether one should follow Eloesser and dilate all strictures or whether the principles of Coryllos should be followed and all tuberculous strictures be closed, remains to be answered. Certainly with this double duty instrument as described, a clinician can either dilate or close a stenosed bronchus.

If there is a secondary infection distal to a stricture, the treatment should be directed toward dilation of the stricture to allow the infection to drain. Negative galvanism is by far the most satisfactory method that can be employed to secure dilatation.

This method of galvanism is being employed clinically for the treatment of bronchial strictures, secondary to pulmonary tuberculosis. The results will be presented in a future paper.

Summary

1. The galvanic current can be safely applied to the bronchial mucosa in small intensities.

2. A current of 3 milliamperes flowing through a copper tip electrode attached to the negative pole of a galvanic apparatus is effective in dilating bronchial strictures, and dilatation occurs immediately.

3. The number of dilations required to secure a good result is proportional to the amount of scar tissue present.

4. Larger amounts of current; namely, 10 or more milliamperes flowing for two minutes, increase the degree of stenosis, regardless of the pole of the galvanic apparatus used for the attachment of the active electrode.

5. With small amounts of negative galvanism strictures can be dilated. With large amounts of negative or positive galvanism; the degree of stenosis will become more marked.

References

1. Jackson, Chevalier: Tracheobronchoscopy, Esophagoscopy and Gastroscopy. St. Louis, The Laryngoscope Co,. 1907.

2. ————, and Jackson, Chevalier L.: Bronchoscopy, Esophagoscopy, and Gastroscopy. Philadelphia & London, W. B. Saunders and Co., 1934.

3. Eloesser, Leo: Chronic Bronchial Stenosis. Internat. Clin. **2**:191 (June) 1935.

4. ————: Bronchial Stenosis, J. Thoracic Surg. **1**:485 (June) 1932.

5. Kernan, J. D.: Treatment of Tuberculosis of the Trachea and Bronchi, Ann. Otol., Rhin. & Laryng. **47**:306 (June) 1938.

6. Coryllos, P. N., and Ornstein, G. G.: Giant Tuberculous Cavities of the Lung, J. Thoracic Surg. **8**:10 (Oct.) 1938.

7. Eloesser, Leo: Blocked Cavities in Pulmonary Tuberculosis, J. Thoracic Surg. **7**:1 (Oct.) 1937.

8. Adams, W. E., and Vorwald, A. J.: The Treatment of Pulmonary Tuberculosis by Bronchial Occlusion, J. Thoracic Surg. **3**:633 (Aug.) 1934.

9. Coryllos, P. N.: How Do Rest and Collapse Treatment Cure Pulmonary Tuberculosis? J. A. M. A. **100**:480 (Feb. 18) 1932.

10. Colwell, Hector A.: An Essay on the History of Electrotherapy and Diagnosis. London, William Heinemann, 1922.

11. Kovács, Richard: Electrotherapy and Light Therapy, Philadelphia: Lea & Febiger, 1938.

12. Sampson, C. M.: A Practice of Physiotherapy. St. Louis, C. V. Mosby Co., 1926.

(Concluded on page 766)

MODERN CONCEPTS OF PROPHYLACTIC AND CORRECTIVE EXERCISES *

JEROME WEISS, M.D.

Attending Physical Therapist, Hospital for Joint Diseases,

and

H. J. BEHREND, M.D.

Associate Physical Therapist, Hospital for Joint Diseases, Visiting Physical Therapist, Welfare Hospital,

NEW YORK

It is only in recent years that the value of corrective exercise has come to the attention of the physician and the orthopedist. The purpose of our paper is not to tell how corrective exercise should be administered for all conditions, as this could hardly be adequately done in less than several lengthy volumes. We propose instead to touch upon several particular conditions which the practitioner is most likely to encounter in his daily work. We would also call attention to some of the newer equipment which has been developed to facilitate the administration of prophylactic and corrective exercises.

Of perhaps greater importance than the treatment of deformities is their prevention. Many deformities generally considered idiopathic have a definite cause and actually are preventable. Many cases of scoliosis are seen each year and for lack of any apparent cause are classified as idiopathic. Anyone who has seen the astonishing improvement which these cases show if treated early, before the changes become fixed, cannot fail to understand how they can be avoided. The average case of functional scoliosis comes to the attention of the orthopedist usually at a late stage when the value of corrective exercise is lessened and necessitate drastic orthopedic procedures. Examination of the very small child even below the age of two years will frequently reveal to the trained observer those slight or marked signs of muscle imbalance which will later lead to scoliosis if left uncorrected. A prominent scapula, a drooping shoulder, inequality of the extremities, habitual strained posture or imbalance of muscle tension form some of the outstanding points to be noted. It is true that there are many deformities which have a definite and apparent cause. Some of these are congenital, while many are hereditary. In many of these cases, for instance in club foot or congenital hallux valgus, prophylactic therapy will naturally be of no avail.

Many postural and other defects develop in older children, who in earlier years show no apparent abnormality. This raises the question how we may select those who require prophylactic exercise. As we have stated in a previous paper, in the majority of cases we cannot tell which child will grow straight and which one will develop postural defects. Our duty as supervisors of the rising generation is to make prophylactic exercise available to all children of school age and particularly of pre-school age.

To this end there has been developed a highly efficient technic and equipment suitable for use in the school and the physician's office. Some of these exercises require apparatus while others do not. None is strenuous or exhausting.

Muscular education can be effected best during the early years of life,

* Read at the Eighteenth Annual Session of the American Congress of Physical Therapy, New York City, September 8, 1939.

as it is during this period that the body still has the degree of flexibility which it is so desirous to preserve. Carefully supervised exercises will prevent the formation of habit errors in posture and carriage.

In our attempts to further this work we have met with some astonishing objections from unexpected sources. Physicians to whom we anticipated our views as outlined above would be most obvious, were reluctant to consider directed exercises for apparently healthy children. Parents on the other hand often felt that such measures given under the direction of trained technicians by the physicians order would be inferior to that which the child may select by self determination. They also felt that outdoor exercise of any kind was to be preferred to indoor gymnastics. Both parents and physicians expressed great fear of exposure, as though the carefully administered gymnastics in some way would render the child more susceptible to catching cold than his ordinary play and exercise.

The exercises are given with three principal objectives in view; namely, to strengthen the muscles of the chest to benefit the circulation and respiratory system; to stimulate the abdominal muscles to improve the function of the intestines, and to strengthen the muscles of the back for an obvious purpose.

Contraindications to this form of therapy are few. The child, of course, must be of normal mentality, and should be free of any acute infection or serious illness.

The exercises themselves will follow and must not differ too much from the well known routine of all so-called gymnastic systems. We must observe the play of the antagonistic muscle groups and any deviations from the normal. For more details we refer to our previous paper.

We call attention to several conditions amenable to corrective exercise and manipulation and which the practitioner will most frequently encounter. Some of these can be prevented by proper prophylactic exercise, while others cannot. One condition which is frequently seen and which is an endless cause of annoyance to the patient and difficulty for the physician is low-back pain.

The method of treatment to be selected depends upon the local diagnosis and the general analysis of the patient, which is sometimes very difficult and complicated. Many cases of low-back pain prove to be entirely other than orthopedic in nature. Frequently the gynecologist or even the urologist gives the ultimate relief to a sufferer with this complaint.

In mentioning manipulative treatment of patients suffering from low-back pain it is our desire to advocate conservative treatment of most orthopedic conditions of the back. Quite a number do not respond well to manipulation under anesthesia followed by a plaster cast. Many authors brand any forceful manipulation as contrary to physiologic concepts. It very frequently leads to the development of more or less extensive hematomas, and therefore to new adhesions which may be as painful as the former condition. In conservative manipulation the operator is guided by the patient's sensation and therefore knows the permissible limits. This form of corrective exercise should be performed by the physician himself and should never be left to the technician.

A certain number of patients with low-back pain and sciatica will eventually prove to have extrusion of the nucleus pudposus of the intervertebral disc. Fear has been expressed that manipulative treatment in these cases prior to diagnosis will do considerable harm. It is our contention that harm will not result but rather that failure to benefit the patient by such treatment will aid in early establishment of the correct diagnosis.

Manipulations of Bones and Joints

Almost all pathologic conditions of the bones and joints, whether acute or chronic, inflammatory or traumatic, sooner or later lead to complications involving the musculature attached to or connected with the diseased bone or joint. The muscle passes into a state of spasm or contraction of its fibro-elastic elements and develops a condition known as fibrositis. On examination such a muscle feels hard and infiltrated and the slightest touch causes severe pain. Sometimes in traumatic cases this secondary muscle involvement remains a source of annoyance after the original injury has healed. These cases form a large proportion of those which offer a difficult problem in compensation and other insurance work, but also those in which conservative manipulative treatment will often produce most encouraging results. When we deal with acute inflammation of the sacroiliac or other joints, rest and support form the treatment of choice and any manipulation would aggravate the condition. When we deal with a condition Mennell has called "locking" or with one of primary or secondary fibrositis, manipulation will give quick relief. These are the well-known cases of osteopathic "miracle cures" where manipulative maneuvers bring spectacular relief as for instance in acute strain of the lower back.

Many of these conditions are associated with tightening of the posterior muscle groups of the lower extremities. Special attention must be directed to detection and correction of this syndrome. This syndrome is of far-reaching importance in complaints other than those of the lower back and sciatic region. Many ailments of a most obscure nature have been traced to this difficulty and corrected by the simple manipulative treatment which we have found effective.

Manipulative treatment must be directed toward relieving muscle spasm when it has been detected. Cooperation and relaxation of the patient are essential, and the operator must be persistent as relief is rarely obtained except by repeated efforts. It is frequently beneficial to combine manipulation with other forms of physical therapy, particularly relaxing hydriatic measures.

Another condition frequently seen is the painful shoulder. Here too we are faced with the problem of diagnosis and suitable therapy. The lesions most frequently found are bursitis, arthritis, or periathritis. Care must be taken to detect the occasional presence of bone malignancy. In acute bursitis manipulation is definitely contraindicated. In this stage other physical measures are of definite value. In the subacute stage or the more chronic phases of bursitis manipulative treatment carefully administered is of the greatest value in preventing adhesions and limitation of motion.

It is most tempting when a stiff shoulder is encountered to administer an anesthetic and restore complete motion at once, but it is only in the rarest instance that this method is successful. The warning which we expressed above holds true to an even greater degree in manipulation of a shoulder. Frequently under anesthesia we find that the shoulder can be moved with surprising ease. However, once the patient has reacted from the anesthetic the shoulder pain is such that he holds it more rigidly than before. Meanwhile extravasated blood in the capsule and surrounding tissues has time to organize and cause greater disability than before. It is in these cases that conservative treatment is of the greatest value. Gentle manipulation combined with other therapeutic agents and carried out with the patient's cooperation will give the desired results in most instances. Dense fibrous or bony changes, of course, require surgical intervention. Manipulative treatment is best preceded by some mild form of heat ap-

plication, which may be either diathermy or the steam jet. This is best followed by gentle massage by mild surface stroking and slight vibration for the purpose of relieving the muscle spasm. Where myogelotic masses are detected, more forceful local massage in the form of deep friction should be administered.

After the massage, manipulation may be instituted. It is advisable to start with the patient in the supine position, lying flat with a small pillow under the head. The arm is moved forward, upward and then carried backward until further movement is limited by pain. It must be carried slightly beyond this point, and so held for a few seconds. The arm is then carefully and slowly restored to the neutral position at the side and left so until pain has subsided. In the second maneuver the arm is carried into abduction until further movement is here, too, limited by pain. The shoulder is then abducted a little further and again held for a few moments. It is then slowly restored to the neutral position at the side and the patient rests until the pain subsides. Mild massage applied between movements will aid in easing the pain. These procedures are repeated several times depending upon the severity and duration of the affection.

The patient then is treated in the sitting position. The above manipulation is repeated in this position, and the shoulder is rotated slowly in all planes.

Finally the treatment is repeated with the patient standing. In this position internal rotation of the shoulder is carried to the greatest possible degree. This will frequently be the most difficult procedure, but it is very important. In all these manipulative procedures we cannot stress too strongly the need for care and consideration. The patient must be carefully observed and his endurance estimated. Loss of confidence will mean loss of the patient and almost inevitable stiffening of the shoulder, which will require operative intervention. Beneficial results must not be expected immediately, particularly in a case of long duration. Apparently hopeless conditions have responded in a satisfactory manner after treatment extending over periods of six weeks to even a year.

The Sayre suspension apparatus forms a simple, inexpensive but valuable equipment. There are many conditions which may be successfully treated with this apparatus. Hanflig has given a classic description of the method in the treatment of pain in the shoulder girdle, arm and precordium due to cervical arthritis. Recent investigation has shown the importance of the anterior scalenus syndrome in the production of similar pain. Although surgery still remains the ideal treatment for this syndrome many cases will receive spectacular benefit and frequently complete relief of symptoms by simple stretching and Sayre suspension. Local massage and sinusoidal treatment are valuable adjuncts.

A paper on corrective exercise would hardly be complete without mentioning of the problem of scoliosis. Nor is it possible here to even attempt more than mention of the subject. Here is a problem, the solution of which resolves itself into a matter of prophylaxis and treatment. We contend that the more extensive the prophylaxis of scoliosis is applied early in life, the less will be the incidence and treatment in later years. This brings us once more to the desideratum expressed in the opening paragraphs of this paper. We hope to arouse the interest of the profession to the institution of prophylactic exercise wherever possible, to reduce the appalling incidence of deformities which if left uncorrected require surgical intervention as the only solution.

Bibliography

1. Weiss, J., and Behrend, H. J.: Prophylactic Exercises for Children, New York State J. Med. **39**:2044 (Nov. 1) 1939.

2. Sweet, C.: The Teaching of Body Mechanics in Pediatric Practice, J. A. M. A. **110**:419 (Feb. 5) 1939.

3. Neumann-Neurode, D.: Saeglingsgymnastik Sportbibliothek. Fourteenth-Fifteenth Edition, Leipzig: Quelle & Meyer, 1934.

4. Stewart, H. E.: Principles Underlying Modernized Corrective Exercises, Arch. Phys. Therap. **19**:103 (Feb.) 1938.

5. Hanflig, S. S.: Pain in the Shoulder Girdle, Arm and Precordium Due to Cervical Arthritis, J. A. M. A. **106**:523 (Feb. 15) 1936.

Discussion

Dr. F. H. Ewerhardt (St. Louis): This paper by Drs. Weiss and Behrend has stressed the importance of corrective and remedial exercises in medicine. They have not attempted to cover the entire subject, but have given enough to show what can be done, and what usually is not done. It is a sad commentary that the physicians as a class have not received more instruction in corrective and remedial exercises. An understanding of the reaction of passive, voluntary active and resistive movements is of inestimable value to the physician who uses physical measures in his practice. An understanding of the theory of inhibition, so ably defined in Dr. Huddleson's paper which we heard this morning, is as fascinating a branch of medicine as any I know.

Dr. Behrend spoke of a number of conditions which may well be benefited by a proper application of exercise, but which unfortunately cannot all be discussed at this time. He mentioned the matter of prevention of curvatures and poor posture by early application of exercise. In connection with this thought I am reminded of several studies which have been made which clearly indicate that very little progress has been made during the last decade or two in the field of physical education tending toward an improvement in the matter of posture. Statistics of today show that approximately the same percentage of good, fair and poor posture is present in college men and women today as thirty years ago. This, to my mind, reflects a weakness of our physical educational program in our grade and secondary schools. Dr. Behrend evidently believes in the theory of teaching good posture in the earlier years, and has shown an interesting method of procedure in teaching not only the child but also the mother.

Some cases of lower back pain lend themselves peculiarly to the application of corrective exercise. This is true also of the art of manipulation which to my mind has not received proper recognition. The medical profession has too long allowed the matter of joint manipulation to remain in the hands of cults with an inadequate knowledge of anatomy, and it behooves the medical profession to incorporate this science in its practice. We refer, of course, to selective cases only.

Dr. Jesse T. Nicholson (Philadelphia): A most pertinent recommendation of the essayists is the examination of the pre-school child and attempt at prophylactic measures to prevent deformity. The usual period for a deformity of the spine to be noticed is at twelve or thirteen years. This is a period of rapid growth in which the musculature cannot keep up with the greater work stress put upon it. Idiopathic deformity of the spine, as the authors mention, is a term becoming less frequently used as greater numbers of attributable causes are recognized. Musculature imbalance, particularly that caused by paralysis, either of the flaccid or spastic type, is generally responsible.

Posture is also a factor producing muscle inequality. This is particularly true after a prolonged illness in which the child was permitted to remain on one side in order to see out of a window or to eat from a tray. This constant position of propping on one elbow is apparently responsible for over-development of the musculature on one side of the back. In a like manner, a habit of sitting in a bad position at a desk or walking in a poor posture, especially in carrying large school books, are attributable causes.

Infection is responsible for the development of deformity primary to vertebrae of the spine or in trunk musculature, particularly chest infection, such as empyema, complicated by pleural adhesions. Nutritional disturbance affecting the skeleton, as rickets, is a pertinent factor.

Such developmental abnormalities as chondrodysplasia, or osteochondritis, are further considerations. Congenital deformities are frequently discovered in individuals with faulty posture. These congenital deformities vary from those of musculature origin, like torticollis, absence of pectoral muscles or of the serratus magnus, to one of vertebral defect or anomaly.

If in this pre-school age a poor posture or a beginning curvature were noticed, an x-ray of the spine and careful muscle examination made, it is quite likely that the etiologic factor could be found. The training of this pre-school age and particularly of the early school child, is especially important from the postural standpoint in order that he should overcome bad habits which would later lead to deformities. Where early structural deformities exist, exercises are important adjuncts to the plaster cases, corsets and braces maintaining the correction.

Drs. Weiss and Behrend have mentioned conservatism before manipulating the back. This is a wise precaution. It is of utmost importance to emphasize the necessity of an x-ray examination before manipulation, even of an "acute back," in order that infection, metastatic processes, fracture or osteoporosis might be discovered and irreparable damage to the individual avoided.

The recognition of abnormal back musculature is most difficult. The authors speak of fibrositis of muscles. This has frequently been seen, of course, in the extremities following trauma or infection, but in the back musculature it is an entity which is extremely difficult for most of us to evaluate.

From an orthopedic surgeon's viewpoint, fibrositis is rarely thought of, as back pain is generally attributed to a bone or joint lesion. It is certainly an important consideration which should be thought of in connection with painful backs more frequently.

I am not willing to say that lumbosacral strains are improved by manipulation. I think that immobilization is of most value, and this must be accompanied by exercises to keep up the musculature and maintain a corrected posture through the duration of the immobilization. I have been impressed with the frequency of sacro-iliac strain responding to manipulation. It is difficult to say what manipulation to use to produce relief from symptoms. Sometimes it is posterior rotation and at others anterior rotation, or again an anterior or posterior slip.

Muscle and fascial contractures are important factors in back pain. This is particularly true of hip flexion contracture and abduction contracture. This latter phenomenon was pointed out a few years ago by Dr. Ober. The benefit from dividing the fascia lata of the thigh in such cases is frequent. Both conditions, however, can usually be corrected by exercises.

It is difficult for me to conceive the relief of muscle spasm by manipulation. I think that relaxation of the musculature should be obtained before manipulation is done, either by the measures mentioned by the essayists or by infiltration of the muscle in spasm with one per cent novocain.

In the care of a painful shoulder every precaution must be taken, particularly in chronic shoulder disability, not to cause a fracture during the manipulation. Freeing up the shoulder motion is of no avail unless the musculature has been developed at the same time. It is important, therefore, that the patient carry out active muscle exercises in conjunction with the other therapy. These at first are simply muscle-setting with gravity eliminated; then against gravity; and finally with increasing resistance.

A scalenus anticus syndrome frequently accompanies painful conditions about the shoulder, as well as cervical arthritis, and is usually a protective spasm rather than any permanent contracture of the scalenus anticus muscle. Abduction of the shoulder is sufficient to interrupt this muscle spasm and relieve the symptoms. This may be obtained by traction on the upper arm to maintain abduction and external rotation followed by an abduction brace and graduated active exercises.

Dr. K. G. Hansson (New York): Therapeutic exercises include a great variety of subjects. Dr. Weiss and Dr. Behrend have very wisely confined themselves to a theoretic discussion of prophylactic exercises for children; the manipulative treatment of low back pain, stiff shoulders, and arthritis of the cervical spine.

Some years ago I had the privilege of examining a great number of pre-school children and their parents at the Hecksher Foundation. It was interesting to note that many of the physical defects in the parents could be detected in their offspring. We have considerable knowledge in breeding of animals but we have never applied that experience to humans. By selective breeding in dogs we have been able to produce variations of every part of the body. When we examine pre-school children we should also examine the parents and we may get important clues that will help us in prophylactic treatment.

The authors have emphasized the principal objectives in the strengthening of the thoracic, abdominal and back muscles. Other authorities have attacked the problem from the point of view of primitive posture-reflexes. Only the end result is important and I believe there is more than one road to success.

I have been told that many insurance companies prefer sending their patients with low back pain to general practitioners rather than to orthopedic surgeons because the latter employ too radical procedures with added expense, longer disability and no better results. The authors have emphasized the fact that manipulation of the lower back depends on the diagnosis. My advice would be to spend more time on the diagnosis, avoid manipulation in the presence of arthritis, and be sure to re-establish proper muscle balance in all the planes between the pelvis, the spine above and the femora below.

May I advise everyone to read Dr. Codman's classical book on the shoulder, without accepting everything he says about the treatment. The conservative treatment as described by Dr. Weiss and Dr. Behrend should be tried in all cases before surgery is advised.

I would like to add two points to the problem of stiff shoulders. One is the importance of separating as much as possible the head of the humerus from the glenoid fossa, and the other is the usefulness of so-called relaxed motion. These pendulum motions should be performed by the patient three times a day for ten minutes.

I agree with the authors when they advocate the use of the Sayre suspension apparatus in cervical arthritis. I apply heat to the posterior neck muscles while the patient is suspended and follow this up by manipulations.

Dr. Jessie Wright (Pittsburgh): The essayists have brought out the importance of a phase of preventive medicine which has not received much emphasis in the past. We are keenly conscious of the effect of good posture on balance of function not only in the skeletal and motor systems but in all other systems of the body. Correct body mechanics encourages proper function. Where variation from the normal, for the various types of stature, is found, restoration of balanced poise and activity is necessary to prevent the abnormal physiologic from making a transition into the true pathologic.

In outlining prophylactic and corrective programs, one should recognize the importance not only of remedial exercise, but more particularly of developing proper habits to attain a desirable neuromuscular pattern.

When we consider the very fine investigative work which has been done on structural scoliosis for many years, and how, after the most careful orthopedic treatment, part of the deformity almost inevitably remains, we are impressed more than ever that prevention of lateral deviation of the spine is the best answer, or, if a postural scoliosis has become apparent, systematic treatment should be directed not only to correcting the curve, but also to establishing normal body mechanics and physiologic weight-bearing.

After correction of the most common type of club foot, talipes varus, retention of the position depends on holding the correction until the peroneals retract, and exercise is carried out to bring active eversion to normal, thus giving a protective balance of power.

With regard to low back pain, I am interested particularly in the role played by short hamstrings. It seems as if there has not been sufficient attention given to differentiating between hamstring spasm and hamstring contracture. Too often one sees shortening of the hamstrings after recovery from acute sprain. When this state exists there is constant danger of respraining the lower back as a result of unguarded movement with the knees straight, causing the hamstrings to act as short levers exerting a torsion force on the innominate bone through the medium of their attachment to the ischial tuberosity. One should bear in mind the mechanics just mentioned when stretching tight hamstrings; the lumbar spine should be supported and the sacroiliac joints braced in order to localize the lengthening force in the hamstring group. An additional safeguard before stretching shortened hamstrings is first to improve the tone and bracing power of the muscles holding the pelvis steady and guarding the sacro-iliac joints.

In most chronic painful shoulders, unless early aeroplane splint or weight traction has been used, the muscles crossing the axilla, as well as the capsule, are shortened, so that when an attempt is made to abduct the arm, the contractures in the arm pit act as short levers to put the deltoid at a disadvantage and jam the upper end of the humerus against the superior ligaments and acromion process, often irritating an already inflamed bursa. The attempted abduction is then not gleno-humeral but scapular, and no gain is made in improving the desired range of motion. This may lead to so-called frozen shoulder. Taking a lesson from evolution and comparative anatomy, I have used, for the past ten years, a procedure differing somewhat from that mentioned by the authors. Instead of having the patient lying on the back or sitting for exercise, I have used a posture with an angle approaching the four-footed position. From this position the patient is encouraged to let the arm hang loosely like that of a rag doll. Then letting the weight of the arm and gravity tend to disengage the tendency to locking above the upper end of the humerus, the arm is swung backward and forward like a pendulum. The next step is rotation using a suitable weight in the hand to increase the traction. Then circumduction in both directions is carried out, limiting the size of the arc if there is a tendency to scapular movement. It may be desirable to have the individual supervising the treatment assist by fixing the shoulder blade. This initiation of gleno-humeral movement is attended by little or on pain, and all movements in the horizontal plane and against gravity progress more rapidly afterward. Carrying out the exercise many times a day with a small dose each time has been more efficacious than a long period once or twice daily.

Dr. Jerome Weiss (closing): In reference to habits which children acquire, I don't know how it is in other cities, but in ours the children seem to carry a great many heavy school books. We have all seen pictures of the knapsacks of European children, and I wish we could develop that custom in this country. We tell the children to use one arm going to school, and the other coming back home. There is a tendency for a right-handed child to carry everything in his left hand, thus keeping the right hand free to do anything he wishes, or repel an attack, if necessary, and when there is this habit, there is the possibility of scoliosis.

Some of the cases Dr. Nicholson mentioned of scoliosis following empyema are of obvious origin. We are concerned more with cases which formerly were called idiopathic where no cause is ever found. We would like to prevent this type of case so that treatment would not be necessary later on.

Appliances have to be used. We are trying to avoid them as far as possible by suitable treatment and observation early in life. Of course, when we get a case where scoliosis has developed, or some other defect, the necessary appliance must be used. In our clinics we use the cowhorn brace which was developed by Dr. Telson, one of our associates. It is used in the treatment of round shoulders of the type we hope to prevent. In regard to the danger of manipulation, we

feel there is much less danger in manipulation performed without anesthesia. Undoubtedly, injuries have occurred with the patient under anesthesia, but when he is fully conscious he is going to tell you when the dangerous limit is being approached.

I do not recall any instance of damage resulting from manipulation without anesthesia. In lumbo-sacral strain immobilization is usually superior to manipulation of any kind. We have found that traction with the patient in bed, with the foot of the bed tilted up, is also of very great value.

About sacro-iliac slip, I doubt if I recall a case where one could demonstrate such a slip from the x-ray. I remember one of my own professors at Bellevue said that no sacro-iliac slip could occur without separation or fracture of the pubis, or the symphysis pubis.

We had a fireman who was rushing to a fire, and who was run over by the back wheel of the engine. He developed a marked sacro-iliac slip, and also a fractured pubis in addition to other complications. But very rarely are we able to demonstrate such a slip so that we can see whether it is put back or not.

Both Drs. Hansson and Wright's useful suggestions are appreciated and will be remembered. In reference to Dr. Wright's term, "frozen shoulder," I would say that recently we had a perfect epidemic of this type. With injection of novocain we made various attempts to wash them out. One result is a series of frozen shoulders, and we usually use the relaxing steam treatment before attempting any manipulative procedure. One of our surgeons who had referred one of these patients to us watched the procedure, and he called it "defrosting."

STANDARDS FOR PHYSICAL THERAPY AND OCCUPATIONAL THERAPY DEPARTMENTS IN A GENERAL HOSPITAL *

MALCOLM T. MAC EACHERN, M.D., C.M., D.Sc.

Associate Director, American College of Surgeons

CHICAGO

Medical science is continually undergoing changes, and what is new today is likely to be improved tomorrow. Medical science must not be static; it must ever be progressive. The science and art of medicine demand newer and more effective methods than ever before. It is now generally acknowledged that the patient, subject as he is to all kinds of ills, must have forms of therapy of wide range and requiring special skill in many directions. During the present century, many new phases of diagnosis and treatment have been introduced into the great arena of medicine, and the majority of these have been effective and have proved successful not only in saving lives but in hastening recovery and in rendering the results of medicine more permanent and effective.

Physical therapy and occupational therapy have more recently been recognized as most valuable adjuncts in the treatment of many conditions hitherto unrecognized, and every general hospital now finds considerable use for such departments. In order that these departments may function to the best advantage and achieve the desired results, they must be properly planned and equipped and, what is more important, have adequate and trained personnel under competent medical supervision. Very definite standards of training and experience are now set for both of these activities.

It is the marvelous advances in the science and art of medicine which have placed at the disposal of the physician these two valuable aids for the

* Read at the Joint Meeting Seventeenth Annual Session of the American Congress of Physical Therapy and the Twenty-Second Annual Meeting of the American Occupational Therapy Association, Chicago, September 14, 1938.

treatment of patients suffering from certain conditions and under his direction, their use may be safeguarded against the invasion of the cultists who so often prey on patients and render pseudo service, with methods having no scientific foundation. Today, every progressive hospital must recognize that physical therapy and occupational therapy both occupy important places in the modern scientific institution. Unfortunately, some of our profession have not yet fully realized the importance of these adjunct facilities. This may or may not be the fault of the practitioner himself, but it may, too, be the failure of the hospital to call the staff's attention to these facilities or to put the service on a proper basis.

The American College of Surgeons recognizes the indispensable value of physical agents in the care of the surgical patient. The modern surgeon cannot but realize the disadvantage under which he is placed when he is deprived of the use of physical therapy or occupational therapy for his patient. He is indeed losing some of the advantages of scientific medicine, and it may be said without fear of successful contradiction that the hospital management or medical staff who fail to make such facilities available are not awake to the most modern advances in their profession.

The American College of Surgeons carries on as one of its major activities, the standardization of hospitals. This, in effect, means the setting forth of principles of organization and functioning which assure the best possible care of the patient. These principles are flexible and adaptable to every institution caring for the sick and injured. In this work, embracing more than 3,600 hospitals under continual survey, and in its 45,000 surveys during the past twenty years, the College has not failed to recognize the inherent value of physical therapy and occupational therapy. These have been included in the work of hospital standardization, and, in promoting their development, there have been adopted certain minimum standards for hospitals.

I shall first set forth the requirements pertaining to the physical therapy department and will quote, with certain modifications, from our Manual of Hospital Standardization as well as from my book, "Hospital Organization and Management." I hope to present as clear a conception as possible of what we are trying to do. We desire the co-operation, constructive criticism, and encouragement of all interested, in better rounding out the service rendered to the patient in which the American College of Surgeons is extremely interested, the evaluation of which determines the rating of every hospital.

The Physical Therapy Department

Physical therapy has proved especially advantageous in the treatment of fractures, diseases of metabolism and nervous disorders. Its most marked results are seen in orthopedic and fracture surgery. By physical therapy muscle function is maintained until its return to normal; joints are prevented from stiffening during enforced periods of rest, and muscles and tendons are kept from contracting, thereby avoiding continued or permanent disability. The usefulness of physical therapy has not been so extensively developed in other services, but it has, nevertheless, proved its value in hastening convalescence and recovery in patients suffering from certain diseases which respond more readily to physical agents.

The requirements as laid down by the American College of Surgeons in a Minimum Standard for Physical Therapy Departments in Hospitals are as follows:

1. *Organization.* — Hospitals which maintain a physical therapy service

shall have a well organized department with adequate, trained personnel under competent medical supervision.

2. *Planning.* — The physical therapy department shall be properly planned and equipped in accordance with present day standards.

3. *Records.* — A comprehensive system of records shall be available in the department and filed in an accessible manner.

4. *Procedure.* — A definite procedure shall be established for the reception, treatment, and discharge of the patient.

5. *Conferences.* — Periodic analyses of the work of the department shall be made to determine the results.

Organization. — It is imperative that the director of the department be a regular physician specially trained in physical therapy. Without a medical education and special training in this field he is not capable of judging the type of treatment best suited to the patient's condition or of outlining a course that will aid in rehabilitation.

In fact, one physician will often supervise the departments in several hospitals, for it is better to share the services of one physical therapeutist than to have one for each hospital who is not so well trained; accordingly we advocate that these hospitals have a physician in charge who is qualified in that work, so far as possible, these services to be shared by several hospitals if at all possible. This is a necessity because of the lack of physical therapeutists to meet the demand.

There is no difficulty in accomplishing this objective in large cities where one physician may devote his entire time to supervising the department in several hospitals. In smaller cities, however, the problem is not so easily solved. A physician must be found to take charge who will not enter into competition with those who refer the patients. Many hospitals have solved the problem by placing the director of the X-ray department also in charge of physical therapy; undoubtedly the radiologist is familiar with electrotherapy and is a logical person to supervise the entire physical therapy department in the absence of a specialist.

To encourage this we are advocating that the physical therapeutist be a member of the staff and have the same staff status as any other specialist. We started out with the internist and the surgeon and the obstetrician and the gynecologist and the eye, ear, nose and throat specialist, later we added the orthopedic surgeon, the urologist, the psychiatrist and the pediatrician, and down the line, the pathologist and the radiologist and the anesthetist. Now in our staff organization we advocate that there is a status for the physical therapeutist, so that he can have the same standing on the staff as any other specialist.

In addition to having a qualified physician in charge, the department, to be efficient, must have well trained technical personnel. Technicians should comply with the standards of the Council on Medical Education and Hospitals of the American Medical Association which publishes a list of approved schools and has adopted a definite curriculum for the training of physical therapy technicians.

And here I want to say that the registered technician is the one whom we favor today, and we are pleased that the Board of the Registry of the American Congress of Physical Therapy and the American Physiotherapy Association have established these standards, that the American Medical Association has accepted them and is now approving schools for this specialistic service. That is a great advent, and when we go into a physical therapy department it is gratifying to see the certificate of the registered technician framed and hanging on the wall as proof that she is qualified.

We hope that similar advances will be made in training physical therapeutists to insure recognition and a status like other specialists, so that we may encourage more medical men to enter the field.

Planning. — As the major portion of physical therapy is with patients who are ambulatory, the plans for the department may include an outside entrance as well as one connected with the hospital, the latter so planned as to allow patients to be brought in either walking, in wheel chairs, or in their beds. Light and ventilation must be amply supplied. In a climate with abundant sunshine, exposure to natural sun rays can often be used advantageously to replace artificial radiation. The department should be located and planned so as to incur a minimum of cost for the special electric wiring and plumbing. The floor in those sections devoted to hydrotherapy must be waterproof and well drained. In the rooms devoted to massage, mechanotherapy, and the different forms of electrotherapy, the floor should be of a resilient material if the greatest degree of efficiency of the staff is to be maintained. Cork, rubber tile, or linoleum is suitable.

The size of the department, of course, depends upon the extent to which the hospital proposes to furnish the various forms of therapy, which in the widest range embrace massage, water, electricity, heat, artificial fever, corrective exercises, manipulation, ultraviolet, infra-red, sunshine, and the like. It is believed by many authorities that 600 square feet of floor space with at least nine foot high ceilings may be considered a minimum for the small department. However, each institution should have individual consideration in this respect.

Equipment will vary in extent depending upon the development of the department, the types being selected by the physical therapeutist. One who is not trained in this specialty should not attempt to purchase equipment without such advice. I will not list the equipment which should be found as a minimum in each well organized department inasmuch as this is now well standardized. Suffice it to say that in the selection of equipment, that which is recommended by the Council on Physical Therapy of the American Medical Association should be given primary consideration. Possibly the Council has covered a sufficient range of equipment to fully meet all needs. However, since equipment is changing so rapidly and advances are continually being made in its use, it is sagacious to have the best possible counsel before expenditure is made in this direction.

Records. — A detailed record should be kept for each patient treated, showing name, age, location (ward in hospital or address if an out-patient), referring physician, summary of patient's history, particularly stressing any physical weakness, such as valvular disease of the heart, and showing a complete clinical diagnosis. To this is added detail of each treatment given and the patient's reactions. Owing to the variety of agents it is unwise to attempt to use any form for the record and report. A blank sheet headed "Department of Physical Therapy" serves the purpose. First in this record is a summary of the history as outlined, followed by progress notes showing detail of the types of treatment and results produced. At the time of finishing a series of treatments a copy of the record is attached to the patient's chart, or, in the case of an out-patient, mailed to the referring physician. If the series of treatments is prolonged, it is well to send progress reports to the physician at intervals not greater than two weeks. The records of the department should be filed numerically and indexed for patient, disease, and therapeutic procedure.

Procedure. — Physical therapy has so often been practiced by those who were unqualified that for a long time it was held in disrepute. It is only

since noted physicians have turned their attention to its correct administration that its true worth has become widely recognized. Tried methods of treatment shown by authorities to be sound are best adapted to the hospital which is about to open a physical therapy department. A regular time schedule of treatment should be required. The hospital must insist that each patient be thoroughly examined and the diagnosis carefully confirmed before treatment is administered. Much has been done by the Council on Physical Therapy of the American Medical Association to regulate and standardize the various physical types of treatment.

Conferences. — Notwithstanding all that has been said of the value of physical therapy, the limitations of the various types must be fully recognized. It is only through proper evaluation of the improvement obtained and through careful study of end results that the real worth of this branch of medicine can be established. The future success in the scientific development and use of physical therapy depends upon the careful observation of end results. The physical therapeutist should attend staff conferences and contribute to the discussions in an enlightening manner. In this way, he has the opportunity of spreading the gospel of its study.

The Occupational Therapy Department

Occupational therapy, another correlated and valuable method which has had its greatest advancement and progress in recent years, was first used and developed for the more chronic patients, but is now being recognized as beneficial in treating the acutely ill as well. Its value lies in the fact that the patient who is kept rationally busy develops and maintains a healthy mental and physical tone which materially aids recovery and shortens convalescence.

In order that occupational therapy be properly used, the department must be controlled by a trained aide,* the treatment always being under the sympathetic and co-operative supervision of the attending physician. Also necessary is a staff sufficiently large to supervise the work of the patients.

A large percentage of the patients in a hospital for the acutely ill will be treated in bed; hence, the space provided need not be large. But for those who can come to the department there should be a bright, cheerful room, preferably on the top floor of the hospital. As a minimum 300 square feet are necessary for the work room, storeroom, and cupboards.

The most common crafts found in our hospital at present, all or part of which may be employed, are: needlework, crocheting, knitting, jigsaw puzzles, block-printing, puppets, celluloid etching, toy making, plaster casting, weaving, rug making, simple bookbinding, leather work, metal work and simple jewelry work, basketry, rush seating, chair caning, simple woodworking, pottery, and gardening.

Since equipment will depend entirely upon the crafts utilized, it should be selected by the person in charge.

Reports are often made verbally to the attending physician, but this procedure is not approved. It is more satisfactory to make written reports in duplicate, one copy to remain in the department, the other to be attached to the patient's chart.

I have an ulterior motive in advocating such a record. The physician will be more impressed with the value of the therapy if he sees a written report and I think it is better to have it attached to the patient's chart. The work is too varied to warrant the use of a special form, however. Records are kept as in any other department, showing patient's name, location in

* Requirements for the training of occupational therapy aides are published by the Councils on Medical Education and Hospitals of the American Medical Association.

hospital, the occupation used, its extent, and the reactions of the patient. The records should be filed numerically and indexed for patient and craft used. A review of results attested by the records will serve as an invaluable guide in the further development of the occupational therapy service.

Physical therapy and occupational therapy are closely related and I am glad that it is so recognized by the Congress. I am sure that both types of therapy have justified their existence, but there is still much to develop. I am of the opinion that there will be rapid extension of this work not only as to agents or methods but in their application to numerous other diseases. These types of therapy will succeed only so far as there are accurate records of clinical reactions, end results, and other data which should be carefully prepared. The evaluation or appraisal of end results is highly important. The day is past when the patient was sent to the physical therapy department as a placebo or to the occupational therapy department for no scientific reason.

The basis for the therapy in each instance should be determined after clinical study of the patient. It is, therefore, essential that specialists in this work and well trained technicians be available; that members of the medical staffs adopt a clinical interest in these forms of therapy, and that the management of the hospital recognize physical therapy and occupational therapy as being extremely valuable, not only in hastening the recovery of the patient, but in rendering the convalescence more pleasant, and the recovery more rapid and permanent.

Discussion

Dr. Richard Kovács (New York): I agree with the preceding speaker that Dr. MacEachern has covered his subject exceedingly well and I shall make only one or two comments on minor points. The first one relates to Dr. MacEachern's suggestion for the use of a blank sheet for the physical therapy record. Under present day conditions, I think a printed list of the various physical measures conveniently grouped under such headings as thermotherapy, mechanotherapy, electrotherapy, hydrotherapy, light therapy seems preferable because it helps to educate the usually not too well informed staff as to the available methods.

I heard with very great satisfaction the important suggestion that the physician in charge of physical therapy be given a staff position in the hospital. Physical therapy has, at times to work against a great deal of indifference and even antagonism of older men. I have seen some glaring instances of this when I lectured all over the great Empire State in my capacity of Chairman of the State Physical Therapy Committee. In one of the fairly modernly equipped hospitals, the hospital superintendent, the radiologist, and most members of the staff were most anxious to establish a physical therapy department, but the two surgeons in charge would not hear anything about it. It was decided that at the forthcoming annual meeting of the county society I should be called to bring forward all the arguments and convince these men about the advantages of a physical therapy department. However, when it came to the presentation of the subject at the meeting and I was introduced, the two surgeons got up and walked out. That hospital still has no physical therapy department.

Another serious situation is created by the fact that in many instances physical therapy technicians are expected to run departments. While most of them are very fine women and have a great deal of technical knowledge, they have had no training in diagnosis and cannot be expected to prescribe treatment. Between staff members who do not know anything about physical therapy, and technicians forced to assume responsibility beyond their training, physical therapy becomes a hit-and-miss affair and the service is a rank failure in too many instances.

If the requirements of the American College of Surgeons that physical therapy departments in Class A hospitals should be under direction of a qualified physician would be actually enforced, such undesirable conditions would be rapidly eliminated. There are now available in a number of centers opportunities for postgraduate training in physical therapy, and it should be possible for a member of a staff to take off a month or so for concentrated training and subsequently be able to exert some real supervision over the department.

I wish to join all those who welcome

(*Concluded on page 768*)

SCIENCE, NEWS, COMMENTS

Dr. Rivière Honored

Dr. Alexandre-Joseph Rivière, of Paris, who was awarded at the last session of the Congress the gold key of merit and an honorary life membership has recently been the recipient of an unusual honor. A life-size bust of the distinguished physical therapeutist was unveiled in the city hall of Rose-Hill on the island of Mauritius. This was made a gala event for the elite of the British colonial island, participated in by the British Governor, the French Consul, municipal leaders, noted authors and colleagues of Dr. Rivière. We are just in receipt of the latest issue of "L'Essor," the official magazine of the writers' guild of Mauritius, which is entirely devoted to a description of the celebration and the eulogies that were pronounced on the occasion. These testify not only to the eminence of Dr. Rivière as a physician, but praise his humanitarian efforts on behalf of mankind.

Dr. Rivière was born February 20, 1859, on the Island of Mauritius, and after obtaining his doctorate from the medical faculty of the University of Paris in 1884, practiced a number of years in his native city. His inherent talent for research compelled him to seek a wider field of activity, and this he found in the French capital. Thus he represents both the British and the French nations in his person, and though as a Frenchman his loyalty is undivided so far as his own country is concerned, he is a great admirer of the English and equally so of the American people. He has made several trips to speak before American Congresses and it was at the nation's capital that he was awarded the honorary degree of Doctor of Science. His own country has rewarded his invaluable services, both in peace and war, by giving him the accolade as a knight of the Legion of Honor, in which Order he was gradually advanced to the high rank of Commander. He also possesses the coveted decoration of Officer of Public Instruction, awarded him by the Ministry of Public Instruction and Fine Arts, and holds the rank of commander in a colonial Order of Merit.

Although Dr. Rivière is an octogenarian, his physical appearance and energy belie the calendar. Daily engaged in practice, he still finds time to look after his many social and literary obligations apparently without any great effort. His latest honor, therefore, comes to him at a time when one may properly speak of his prime in life, an enviable blessing for a man who has known nothing but hard and constant work since his earliest manhood. We are sure that every member of the Congress joins the editorial staff of the ARCHIVES in heartily felicitating Dr. Rivière on the unusual honor he so richly merits, and in extending to him best wishes for many more years of usefulness to his profession, country and humanity.

The New York Physical Therapy Society

The New York Physical Therapy Society meeting will be held at 8:30 P.M., on Wednesday, December 6th at the New York Academy of Medicine Building, New York. The program will consist of:

1. Scientific Session: A paper on Physical Medicine in Peripheral Vascular Disease. Determination by Means of
   - (a) Capillary Microscopy by *I. D. Stein*, M.D.
   - (b) Temperature Changes in Skin and Muscle by *Mac Friedlander*, Ph.D., *Samuel Silbert*, M.D., and *William Bierman*, M.D. Discussion opened by *Karl Harpuder*, M.D.
2. Executive Session.

Pacific Physical Therapy Association

The regular monthly meeting of the Pacific Physical Therapy Association was held on Wednesday, November 29, 1939, at 8:00 P. M. at the Presbyterian Hospital, Hollywood. The program was as follows:

1. Newer Knowledge of the Vitamins. *Roger W. Truesdail*, Ph.D., Consulting Nutritionist, Los Angeles.
2. Short Wave Diathermy Technic, *J. S. Hibben*, M.D., *R. C. Burt*, Ph.D., and *Albert Bornfell*, R.P.T.T., Pasadena, California.

General discussion followed each of the above papers.

FRED B. MOOR, M.D., President,
CLARENCE W. DAIL, M.D., Secretary,
Loma Linda, California.

Solid "Alcohol" Exhibited at Field Museum, Chicago

Solid chunks of "alcohol" are on exhibition at the Field Museum of Natural History, Chicago. It isn't some new fangled chemical but the mineral stibnite, in sixteenth century Europe called "alcohol." This antimony sulfide, most important ore of antimony, was known to the Arabs as "kohl," from the Arabic for color or stain. The powdered mineral was used as a cosmetic to increase the apparent size of the eye by blackening the eyelids. "Al" is Arabic for "the" . . . hence "al-kohl" or alcohol. — *Science News Letter.*

Correction

In the October, 1939, issue of the ARCHIVES there appeared an article entitled, "Present Status of Education in Physical Therapy," in which the statement appeared that Harvard Medical School is among the schools offering graduate instruction in Physical Therapy to physicians. It has been called to our attention that admission to these courses is restricted entirely to women.

OSCAR BERNHARD (1861 - 1939)

Oscar Bernhard, the father of modern Heliotherapy and one of the most brilliant luminaries of modern medicine, died on November 14, at the age of 78, after a prolonged illness that only heroic stoicism made life outwardly bearable. Born a decade past the half-way mark of the most revolutionary and progressive century in the history of civilization, in that part of mountainous Switzerland which still retains the language of ancient Rome (Samaden) and of parentage that had for centuries been rooted in the same soil, Nature in her inexplicable motivation concentrated her greatest blessings on this highly sensitized child and selected him as the modern interpreter of the healing power of sunshine and climate in surgical tuberculosis. At the age of 23 and the year 1884, Bernhard then an assistant to the great Kocher, came to the conclusion as he watched the varied operations for surgical tuberculosis — a disease which then represented the principal activity of the clinic — that this class of patients could be benefited more by climato-dietetic therapy than by the mutilating operations with their inevitable high mortality.

Maturation of this conviction came at a period shortly after the recognition of the antiseptic method when surgical enthusiasm ran high and extirpation of disease including tuberculosis, was merely a matter of dexterity with scissors and scalpel. It has always required courage to run against the tide of public opinion, but the decision of Bernhard amounted to heroism above the ordinary because it challenged a practice supported by its leaders to a degree tantamount to medical heresy. In the Spring of 1886, he established a clinic in his parents' home at Engadin (St. Moritz) and after a short time his efforts were supported by such great surgeons as Albert, Esmarch, and Socin, who also "looked for an ally who could save it many a hopeless or dangerous intervention, and make science some laboriously attained success (v. Czerny)."

On the escutcheon of Bernhard's life is written in imperishable ink fifty-three years of exclusive study and contributions on the curative value of sunlight and climatotherapy, a life so impressive in its rich service to humanity and in its wholesome devotion to the alleviation of needless suffering that it was responsible for the revival of this ancient practice under the guidance of his scientific spirit. Within the space of half a century an enormous and extensive literature has developed because of the writings and precepts laid down by Bernhard on the biology, pathology and therapeutics of light, so-much-so that it is scarcely possible for one person to evaluate its incredible proportion. His book on "Light Treatment in Surgery," is based on the

(*Continued on page 767*)

ARCHIVES of PHYSICAL THERAPY
OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL THERAPY

.·. EDITORIALS .·.

Our Greeting

The success of the American Congress of Physical Therapy and the ARCHIVES during the past year was due to the fidelity, zeal and support of its members, subscribers and advertisers. To you collectively the officers of the Association and the Editorial Staff desire to express their appreciation, and to wish you a Merry Christmas and a Happy and Prosperous New Year.

THE DESTINY OF PHYSICAL THERAPY

The closing days of the calendar year are ushered out between two such spiritually mellowing holidays as often to evoke a form of philosophic detachment that makes past and present events coalesce into a sweeping panorama surrounded by profound meaning. In such a mood one often finds one attempting to interpret the verities of today by evaluating them by aid of similar experiences under the colored perspective of history. Among us who are united in the same unbroken continuity of method and ideal, the question that often presses for most sincere and frank explanation is one related to the permanency and future of physical therapy in the scheme of the healing art. The whence, whither and destiny of this most ancient practice are of concern to its disciples and students because there is reason to suspect that in the modern integration of knowledge, science must find the universal key to the interpretation of the natural forces existing in our environment and their influence on living structure.

Repeatedly the question of the destiny of physical therapy has been raised in silent thought and has provoked serious and disquieting speculation among the members of our ancient guild. What is in our past to justify our future? For guidance, once again we may turn back to history and read the deeds and ideals of our predecessors, who had kept step with or been in advance of the progress in the culture and morals of succeeding nations and at the obituary of many more. Our noble ancestry is so deeply rooted in the past that we who have inherited this practice, stand as a collective body before the unearthed civilizations and exhumed geniuses of yesterday, and like Hamlet, cry "Alas, poor Yorick!" over the countless skulls of those who inscribed their futile acts of so-called heroics in hieroglyphics to a posterity that in turn interpreted the shadow for substance as a legacy to present-day disillusionment.

Proud Egypt with its empire built on shifting sand and more lasting than any later realm, with temples more magnificent than those of any succeeding period, ruling the Mediterranean peoples with cruel enslavement, embalming her priests and princesses in the "houses of eternity" known as pyramids, was once eulogized as the greatest of nations, but now is elegized

as a cemetery of crumbling ruins covered by desert sands. Its mortality is witnessed by the morbid and the student in every museum through the medium of scattered mummies, but its immortality is today established by a single individual who in his short-lived existence as a puissant Pharaoh, Amenophis IV, proclaimed and deified the healing powers of the sun.

Throughout succeeding periods our astonishing continuity if not solidarity has been a point over which historians have often paused and puzzled, and failed of explanation because the forces of nature operating without potentate and parliament preceded the hero worship of written history. The uses and benefits of heat and water, of sunshine, massage and like practices were so hoary with age that their very identification was coupled with the supernatural acts of mythologic figures. But throughout the fall and rise of nations reality became more differentiated from shadow. Empiricism yielded to criticism and our apostolic succession of physical therapeutists continued unbroken even during periods of indescribable economic distress and political adjustment.

Classic Greece is today a memory of the fame and genius of Ictinus and Mnesicles who supervised the construction of the immortal beauty and now crumbling frame, the Parthenon. Its proportion and style and subtlety of line and curve belong to a period of creative genius that has never seen its duplicate. For nine years Phidias and his pupils carved and modulated the resisting marble into a pliant warmth that outdid nature in its creation of the human form-figures of men whose beauty was an inspiration, figures of gods whose majestic serenity evoked an emotion to worship. Greece that was is a memory and the Parthenon a relic covered by the pathos of the vanishing glory of man. Rome came and bestrode the earth like a colossus, so great in power and pride that even in its fall tourists who astigmatically scramble over the unearthed remains depart with a feeling of awe at the grandeur that once was the greatest of nations.

The deeds of the Greeks and Romans are memories, their ideals and hygienic practices still remain. In the latter sphere our ancient guild was so dominantly active and creative that the profession of medicine became the choice of the cultured aristocrats of these periods. Nowhere in the literature is given us such a charming picture of the cultivated physician in society as that presented by Plato in his *Dialogues* of Eryximachus, himself a son of a physician, Acumenus. It was the period when Hippocrates developed the school at Cos, and where criticism and skepticism laid the foundation of physical medicine that continued to flourish under Galenic teachings for over a thousand years.

This extraordinary era known to history as the Golden Age of Pericles and the enlightened age of Socrates and of Horace perhaps would have been delayed or even lost to us in the travail of time were it not for the single genius of the aged Thales, whose spirit bestrides every corner of modern civilization. It was his prescience that gave birth to one of the most monumental observations of all times and reduced the most exquisite of Greek mythological romances, the "Tears of Heliades" (which Ovid later transcribed into imperishable poesy), into a scientific concept which made possible the greatest of all the ages — the age of electricity. A period of 2500 years has elapsed from amber to Ampere and the forces provoked by Thales' observation of the attraction and repulsion at the rubbing of these frozen tears of the sisters of Phaeton's tragic folly gave birth to a theory that since has grown into the most constructive realization of all time. Thales who was the first to measure the height of the Egyptian pyramids, to demonstrate the bisection of a circle by its diameter and many other geometric

calculations that by virtue of his teachings are to us so self-evident, initiated a new science which for want of a better understanding of the forces involved he conceived as elektros or soul, because of the supernatural action of the rubbed amber. Though time was slow to develop this revolutionary concept because of adverse theocratic and shifting socio-economic forces, its concrete evolution together with the speculations of Democritus and Leucippus concerning atoms and motion was hastened by the sweeping renaissance and the progressive element of our medical guild.

The speculation of Thales required twenty-two centuries to be lifted from oblivion to remembrance by the court physician of Elizabeth, Gilbert, whose book, *De Magnete*, published in 1600, not only had a profound influence on the future students of a new science but was the first to introduce the word elektros into the most universally accepted term — electricity. The birth pains of a new and extraordinary epoch — the age of electrification — were awakened by Gilbert, but it required two centuries for its growth from its fetal stage to an infant prodigy at a period when social and political revolution had no duplication in modern times.

A new economic and industrial era began to manifest itself about the time that initiated the French Revolution. The memories and ideals left behind by other nations became deepened and broadened in new soil. Increasing communication from East to West revived old teachings and stimulated new ideas, among which the medical precepts of time-proven methods were renewed and enhanced and their opposites questioned or rejected. The economic distress of the period gave rise to a social unrest which produced an emotional ferment that questioned the present and challenged the future. The intellectual mood of the occidental countries in 1800 was one of untraditional humility and uncertainty, a state most catalytic to the melting of traditional belief and the breakdown of theological sanctions. The intellectual background was one of despondency as exemplified by Schopenhauer's pessimistic attack on men's faith in progress and civilization, Keats' death from consumption and despair, Shelley and Byron's deaths by drowning and epilepsy, and Pushkin's death after phrasing a poem in such pessimism as never since equalled in Russian literature. In France "Dr. Guillotin" was still practicing cephalic amputation on an unfortunate aristocracy, and Napoleon was in the midst of erasing the national boundaries of Europe with armies bled white for the victories of its Emperor. The *weltschmerz* was stygian in outlook, but the *zeitgeist* was revolutionary and progressive.

It was in such a depressing time and soil that search became exalted in spirit and scope and brilliant in contribution. The urge of necessity made science and invention march forward under the guidance of a score of scientists that laid the foundation of a new era in civilization. Before the turn of the year 1800, Galvani, an Italian physician, had already demonstrated electrical contraction in frogs' legs, and during that same year Volta had communicated to Sir Joseph Banks of the Royal Society of England, his discovery of voltaic electricity. In the same year Herschel's astronomic eye wandered from the cosmic spaces to the spectral region explored by Newton and discovered an octave of thermo-radiant energy below the visible spectrum that was designated by him as infra-red. A year later Ritter and Wollaston exploring the opposite end of the same spectrum found a photochemical source that darkened the silver emulsion of a photographic plate and thus uncovered another octave of invisible energy beyond the violet portion of the Newtonian spectrum, since designated as ultraviolet. Unlike young Alexander who drank himself to death because he had no more lands to conquer, the spirit of science became more encouraged with each succeeding discovery of the in-

visible cosmos and transformed noumenon into phenomenon and harnessed the gods of lightning and sunshine for utilitarian and curative purposes. It but required for that early period of the above mentioned century to discover the electric arc lamp by Davy (1810), the demonstration of electrophoresis by Reus (1807) and the proof of electrolysis and induction electricity by Faraday (1832-1833) to inspire and stimulate an era of research so extensive and extraordinary in results as to have fashioned for mankind a new world to live in and veritable wings to soar the spaces so tragic to Phaeton and so lamentable to his sisters.

In this mood of philosophic and perspective detachment one visualizes the trials and errors and difficulties that confronted those noble pioneers from the days of amber to Ampere and to those of d'Arsonval and views their self-sacrificing labors with awe and poignant tenderness. The spirit of research and discovery in the service of science has often been attributed to the oddities of chance rather than to some inexplicable force in the nature of the individual that defies analysis. The formula is within the realm of reason and is perhaps beyond our own limited conception. One cannot attach any hidden purpose or doctrinal significance to the fact that physical therapy has been practiced throughout the ages and passed through all of the changing fashions, isms and cults to again take its place as an integral part of modern scientific medicine. It lies in the genes and the psyche rather than in chance, that so-called accidents have been turned into formidable discoveries, and kept a medical group united to practice along methods laid down by the forces of nature rather than providence. One royal son of ancient Egypt saw the supernatural healing powers of the sun and by decree deified this curative agent for the welfare of his people; others looked at the sun — and were blinded. One profound scholar of ancient Greece studied the mysterious qualities of rubbed amber and discovered the seeds of the most remarkable force utilized by modern civilization; others admired its extrinsic beauty and loved the pathos of Ovid's metric story about the daughters of Helios.

The tragic story of the stolen fire from heaven by Prometheus as dramatized by Aeschylus is today a matter of forced reading of Greek romances by students, but far more provocative and fascinating is the true story of artificial sunshine or ultraviolet rays and its conquest of certain diseases. Its curative effect on lupus vulgaris gave Finsen the Nobel prize, and its activation of cholesterol and isolation of vitamin D won Windhaus the same recognition. The equally deserving discovery of Huldschinsky of its curative action on the rachitic state has been recognized by America through the gift of its highest decoration, the Golden Key of Merit, by the American Congress of Physical Therapy. Thus, thirty-two centuries have elapsed from the time that Amenophis proclaimed the supernal qualities of sunshine to Davy's electric carbon arc lamp, a period through which sunshine therapy was not only practiced with increasing favor by the profession but which has since been revived in its most impressive natural form by Bernhard and his pupil Rollier under the most critical clinical observations.

The twentieth century with its vast treasure house of experience and information offers the best vantage point for a rational evaluation of the destiny of physical therapy. If this had been examined in the light of nineteenth century clinical achievement, pride would have pointed out the materialistic and mechanistic advances and so predicted its permanency in medicine. Today, our broader education has seen the moulting of dogmas and the progress in the art of doubt. Yesterday matter was conceived as indestructible, inert and tangible; today matter is energy in motion with elec-

tric charges and waves which under proper guidance manifest themselves in calculable ways from the insulated flow of low and high frequency current to radiant energy recognized as heat, light, actinic, roentgen, radium and cosmic radiation. This energy is alive with cohesions, affinities, repulsions, electrolytic and osmotic action, with electric heat, light and electrons in restless motion. Thales interpreted the universe as a derivative of water, fire and air, and Hippocrates and his school saw in this trinity the fundamentals of all therapy. The basis of modern physical therapy is the application of energy in its all inclusive form under certain mechanical boundaries. Today therapy in its most scientific connotation is first studied and developed by virtue of its basic sciences, and confirmed at the bedside. The destiny or fate of physical therapy is today singularly rich in promise because the study of all fundamental sciences is already being integrated, unified and correlated into a basic science that is attempting to interpret the normal and pathologic changes from the point of view of its physical action. All externals and internals are today being interpreted as various facets of one energy. Thus at the bottom of physiology is electrophysiology; at the bottom of chemistry is physical or electrochemistry; at the bottom of pharmacology is the electronic formula of the drug and its electric polarity. Life and its minutest components are today recognized as possessing electrotaxic, photo- and electrotrophic qualities which will be taught in greater detail as a part of the medical curriculum. Accordingly, the destiny of physical therapy is that it will be integrated as a part of the most scientific era of medicine, and its precepts will be the sanctum through which all therapy of the future will be interpreted and employed. It is an eventuality as certain as has been the acceptance of the fundamental nature of electricity.

SIGNIFICANCE OF THE INDEX

The ARCHIVES being a specialistic periodical containing a fairly large number of diversified items in each issue, an Index is prepared after the forms for the December issue are closed, to enable the reader to locate any article, book review, or abstract by the numbered page. In this the present Index does not differ from that provided by other medical or literary periodicals. What is of interest, however, is that virtually, a mere glance at the table of contents at once conveys a fairly accurate idea of the quantity of the material provided within the current year. It will be seen that this consists of 84 original articles, 30 editorials, 86 book reviews, and 150 international abstracts, totaling 350 original and special articles. The Index does not include the innumerable amount of news items, though plans are contemplated to incorporate them in future indices.

Considering the limited means at the disposal of the publication, it cannot be gainsaid that from a purely quantitative point of view the readers have been given full value. The numerical aspect is, however, of comparatively little interest, for in the last analysis it is not quantity but quality that determines the value of any publication. From this latter point of view we feel confident tribute is due to the many distinguished authors whose literary productions have been published this year. True, the same holds good for many of the preceding volumes of the ARCHIVES, but careful comparison will show that there has been a constant trend of progress. So far as the editorial labors are concerned, these have been in part at least of an eliminating nature, for there have been sent in quite a number of articles which had to be rejected, principally because they presented merely well-known facts in new clothes. The decision to print nothing that will not add to our sum total of knowledge or, under circumstances, that will not affect the weal of our membership as a body, has been maintained without fear

or favor. When it is considered that most of the original contributions have been abstracted in many American and foreign medical journals of both a general or specialistic nature, often in extenso, then the quality of the original articles must indeed be of a high grade.

If the function of an editor is not to be merely one of a glorified proof reader, then he must have the means for authoritative expression on any subject of interest to the medical profession in general and physical therapeutists in particular. It will be seen that this obligation has been met within the limits imposed on all editorial comments. Whenever it was deemed necessary or appropriate, certain technical problems have been stressed with a view of calling especial attention to their importance, or else certain social and economic interests pertaining to our practical lives have been discussed in no uncertain manner. Part of the duty of an editor is to select for review only such books that have actual merit, or else frankly to point out books sent in for discussion without such merit, so that the readers may be kept advised about the worthiness or otherwise of the many annual productions in the book market. The abstracts are culled from American and foreign periodicals with considerable care, the space available for them being utilized to benefit the majority of our readers. Often, of course, one would wish more space to be given to more extensive abstracts, but even where this is impossible, the sources are given, so that the original contributions can be looked up in any medical library.

Again the Index reveals the trend in preference of certain fields, or those that receive especial attention. Thus this year the old neglected field of ultraviolet radiation has been taken up in earnest and new data have been added with regard to indications and technics. Hyperpyrexia has been stressed, as is natural with a powerful therapeutic agent which still offers a number of problems for solution. Electrosurgical procedures continue to hold the interest of many authors. Finally one notes a greater tendency to avoid absolute restriction to the sharply drawn borders of physical therapy and to emphasize the close relationship with other disciplines to the effect of bringing about greater utilization of combined methods of research and treatment.

Galvanism in Bronchial Strictures — Kernan and Baker

(*Continued from page 715*)

13. Althaus, Julius: A Treatise on Medical Electricity, London, Longmans, Green & Co., 1873.

14. Uthoff, Carl J.: Galvanism in the Treatment of Ureteral Stricture. Urol. & Cutan. Rev. **42**:240 (April) 1938.

15. Jones, H. Lewis: Ionic Medication. Philadelphia, P. Blakiston's Sons & Co., 1914.

16. Adams, W. E.: Detailed Description of a Safe and Reliable Method of Closing Large Bronchi, J. Thoracic Surg. **3**:198 (Dec.) 1933.

17. Wood, C. B.: Experiments in Endobronchial Stenosis, Proc. Soc. Exper. Biol. & Med. **30**:1266 (Jan.) 1933.

Oscar Bernhard

(*Continued from page 760*)

study of 2,500 patients with surgical tuberculosis, and evaluated the vitalizing influence of natural and artificial ultraviolet sources for their beneficial effects on tuberculosis of the skin, tendons and bursae, lymph glands, bones and joints, the genito-urinary system, serous membranes (pleuritis and peritonitis), intestinal tuberculosis, the organs of senses and multiple localizations.

In the light of his contributions which have since been verified and extended by an ever increasing number of disciples, many in the profession are today in agreement with his frank and conservative opinions on the limited values of much of our medication in the management of tuberculosis and with Bernhard voice the aphorism of Paré: *Je l'ai operé, Dieu le guéira* ("I have operated on him, God healed him"). No student of light therapy should rest content until he has read this erudite and fascinating book; no heliotherapeutist can remain satisfied with the inspiration culled from average books or classroom lectures unless amplified by Bernhard's chapter on the historical background of his discipline. One comes away from this source amazed at the rich treasury of ancient appreciation of sun therapy, practiced with veneration by the Mesopotamians 5000 B. C., a people whose advanced culture was so well developed that the Egyptians copied their system of medical practice several thousand years later. The ancients glorified their gods; the moderns pay homage to man for teaching us the god-like benefits of nature.

To have seen Dr. Bernhard in his home surroundings in the village of St. Moritz is to have appreciated the scientist and the man within the frame of an unusual environment. From the world famous Hotel Kulm to his chateau is a matter of many windings, steep-graded and narrow climbing roads, which at the end of no little physical effort brings one before the front of a deeply mellowed three-storied, impressive villa that had defied the erosion of time for over three centuries. With slight modification in architectural modernization this home had been the birthplace of many generations of Bernhard's antecedents and promises to remain the home of many future one's of the same family. It was a noble edifice lost in rich Alpine foliage, rooted on a hill that overlooked a distant ridge of glacier-capped mountains and into the depths of a lake in the valley beneath that seemed imbedded as a mirror for the reflection of nature's rugged grandeur. The waiting salon of this impressive home left a feeling of cool cleanliness, and the subdued midmorning light brought out in relief the warm background of wood-carved walls as well as an antiquarian's delight in the classic furniture and rich paintings. The noise of an opening door directs one's eyes to the presence of a white mustached, snow-haired man of medium height who is advancing with soft greetings and beaming face to welcome one in an English whose sincerity rises above the quaintness of tongue like the harmony of musical octaves. One is conducted by him through many chambers touched with the grandeur of age into a high vaulted and widespreading room in which books on walls, on floor, on desks appear to welcome one into the silent intimacy of a great student's study and the workshop of a cultured gentleman's avocational pursuit.

The several hours spent in this informal cloister disclosed the great intellect and the gentle modesty and simplicity of a rare and gifted man. Through his vocal recollections of fifty years of labor one visioned the epic of the modern birth of heliotherapy and the progress in the therapeutics of ultraviolet radiation. What one did not grasp by ear one soon saw by eye, for his model clinic adjoining his home presented the evidence of time and experience modulated for the benefit of patients of highest and humblest rank. In this sanatorium the gratitude and admiration of an appreciative humanity has been written into a visitors' book by the many whom he had treated, and their inspired comments bore the signatures of some of our most outstanding names of this and the past generation.

Dr. Bernhard's avocation was the study and collection of ancient coins. As a numismatist he received international recognition, not merely because he was able to discover, describe, decode and collect the rare coins of Grecian and Roman antiquity, but to interpret the very botanical configurations on coins of ancient dynasties and had the generosity of the sincere student to duplicate many of these in special plaster casts for the benefit of museums and their clientele. His two outstanding monographs in this field are "Plant Pictures on Greek and Roman Coins" and "Greek and Roman Coins and Their Relationship to the History of Medicine."

The passing of this distinguished scholar and physician recalls that his life was full of achievement and rich in the honors bestowed on him by scholastic, national and medical institutions. Of the honors that evoked the warmest response and which he treasured most highly was the Golden Key of Merit of the American Congress of Physical Therapy, awarded him in 1934. His interest in the advances of Physical

Therapy in America has been manifested in constructive correspondence and scientific communications. It had been the intention of the ARCHIVES to devote a future issue to his life and services to medicine in the form of a Jubilee number, which fate unfortunately has interrupted. The brilliant genius and gentle spirit of Bernhard has tarried long enough on this earth to leave the fruits of his labors in a shape so eternal that future mankind will have reason to show gratitude for the spirit of his contribution long after the signature has been forgotten. On the other hand, medical history will enshrine the name of Bernhard among its heroic figures who dared challenge nature and wrest victory from the jealous gods for the great good of mankind.

CORA KING (1872 - 1939)

It is with profound regret that the ARCHIVES announces the untimely demise of Dr. Cora Smith King of Los Angeles, on November 23. Dr. King was one of the most enthusiastic members of the Congress whose activities and contributions from time to time had received merited appreciation by our membership. In many respects this woman was far more than a mere physician for she betrayed an intellectuality and personality seldom found combined in one of her sex, devoted to a professional career. All who had the pleasure and privilege of coming in contact with her will recall her kindly approach and sincere cordiality which made friends wherever she was given an opportunity to exert her influence for the betterment of organized physical therapy. Yet those who were familiar with her entire career from the day of her graduation in medicine and her many national activities in Washington and later as a physical therapeutist on the Pacific Coast, have learned to know that this gentle lady possessed a will power and firm conviction seldom paralleled by the spirit of sturdy pioneers. Once she was convinced that even a forelorn cause was right she fought off all sectarian attacks, no matter how influential the antagonist may have been, with a determination and zeal which evoked respect and admiration even among those who faced her in opposition.

Throughout her career she manifested the keen mind of an earnest student who found diversion from her arduous duties in the study of Nature and in social activities aimed to benefit our entire people. With her passing Physical Therapy loses an outstanding yet gentle and gracious devotee, whose memory will long be cherished by all who have been associated with her. Our former President Dr. J. Severy Hibben eulogized her life and career in a befitting manner when her remains were layed at her well earned rest. *Requiescat in Pace.*

Standards for Physical Therapy and Occupational Therapy Departments in a General Hospital — Mac Eachern

(*Continued from page 758*)

increased cooperation with occupational therapy. I think we have all enjoyed the joint meetings and the spirit that permeated through them. During my early work in physical therapy at the Reconstruction Hospital in New York, I learned to appreciate working side by side with the occupational therapy department. I think that for the sake of the patient and for the efficiency of the service, a close cooperation of the two departments is most desirable.

The closing words of Dr. MacEachern, in which he gave us a picture of the present constellation, the cooperation of the American College of Surgeons with the Council on Physical Therapy of the American Medical Association and with our own Congress, augurs a very bright future for this work and will redound to the benefit of our patients and to the credit of our specialty.

THE STUDENT'S LIBRARY

ANESTHESIA. Narcosis, Local, Regional, Spinal. By *A. M. Dogliotti*, M.D., Professor of Surgery, University of Modeno, Italy. Authorized English translation by Carlo S. Scuderi, M.S., M.D., F.A.C.S., Associate in Surgery, University of Illinois, College of Medicine. Cloth. Pp. 680 with 17 tables and 236 illustrations. Price, $7.50. Chicago: S. B. Debour, 1939.

Dogliotti's work on anesthesia has long been regarded as the classic in its field and accordingly the publisher and translator have rendered an inestimable service to the English reading profession by placing this text within reach of students and practitioners for the greater service of medicine. Here is a volume whose brilliant scholarship and luminous description of a topic as important as it is neglected makes evaluation a difficult task because of its extraordinary perfection. The classical style and colorful idiom of the author have been captured and revivified by Scuderi into an English that pulsates with interesting data and practical examples. And no less is to be said of the beautiful format — clear type on glossed pages and rich in black and white and colored illustrations — a compliment to publishers who have dug deep into finances to render the physical aspects of this work as artistic as it is impressive in a scientific sense.

The English edition is introduced to the reader by a foreword by Professor Uffreduzzi who points out that the volume is replete with valuable facts and observations, and that it "represents an important pillar of our knowledge in the field of anesthesia." The reason for this warm endorsement is to be found in a text which is as complete as it is clear and well balanced. The author in his preface contributes the key for the success of this text. He points out that the writing of this text was inspired by a desire to contribute something that might illuminate the steps of his successors or contemporaries — a labor that required fifteen years for completion — to alleviate human suffering. In the space of eleven chapters and a comprehensive index, the exposition vividly constructs a colorful picture of the genesis and growth of the art of anesthesia, its theories, practice and progress. Divided into three parts, the first expatiates upon the historical background, the mechanism that influences central and peripheral sensory pathways, and methods of examination before and after operation in relation to anesthesia. Part two discusses the effects of interrupted sensation on the centers described in the first section. This includes a detailed exposition on the general physiopathologic action of narcosis, the administration and absorption, distribution and elimination of narcotics, the signs and stages of anesthesia, accidents, complications and types of anesthesia in modern practice. Part three deals with the qualities of peripheral anesthesia on sensation. This section is as practical for peripheral as the preceding one is for systemic anesthesia. Here also the author provides detail and practical guidance seldom found in any single volume. The topics discussed range from the anesthetic action of cocaine to percaine, their potency, physiologic action and harmful effects, to that of its technical uses in operations associated with regional analgesia. Space will not permit detailed description of the importance and value of this work, and it must suffice to say that it is one of the most important additions to the literature of our profession. The book is a "must" book for all progressive surgeons, students and practitioners of the healing art.

HANDBOOK OF PHYSICAL THERAPY. Selections Authorized for Publication by the Council on Physical Therapy, American Medical Association. Third edition. Cloth. Pp. 537 with illustrations. Price, $2.00. Chicago: American Medical Association, 1939.

It is a source of satisfaction to those especially interested in physical therapy and to the profession at large that this handbook of the American Medical Association has passed through three editions on a form of treatment that was wont to arouse the supercilious comments of curbstone authorities despite its recognition and approval by our parent-organization. To organized medicine the significance of a handbook written under the guidance of the Council on Physical Therapy and published by our national association is tantamount to a Magna Charta that decrees official sanction and privilege to a practice that had the prestige of antiquity and the authority of modern medicine. The Handbook of Physical Therapy of the American Medical Association in its third revised and enlarged edition represents the most authoritative expression of the value of these procedures in practice and its popularity is the best answer to reactionary opinions. The text proper has been contributed by a group of collaborators recognized for their brilliant work in their special fields and for their collective labors in the interest of organized physical medicine. The increased girth of this edition is due in part to eleven new articles and to revisions of many where recent investigations added new facts. These include, to mention a few, two new articles on short wave diathermy; one on galvanic and faradic currents; a lucid evaluation of electrolysis; a detailed review of the value of artificial radioactivity and neutron waves in biology and medicine; the physiologic effect of ultraviolet radiation; fever therapy, and other timely expositions of interest to the profession. As in past reviews, so now! Every topic is discussed in a critical, conservative and frank attempt to evaluate the most scientific reason for the use of a special agent or technic, and by the same token condemnation of its practice as based upon supported evidence. Accordingly one may unquali-

fiedly recommend this book as the most earnest and honest, the clearest and most practical, the most conservative and yet progressive exposition of the indication and limitations of physical methods published in any language.

THE 1939 YEAR BOOK OF RADIOLOGY. Diagnosis edited by *Charles A. Waters*, M.D., Associate in Roentgenology, Johns Hopkins University; Assistant Visiting Roentgenologist, Johns Hopkins Hospital, and *Whitmer B. Firor*, M.D., Assistant in Roentgenology, Johns Hopkins University, Assistant in Roentgenology, Johns Hopkins Hospital. Therapeutics edited by *Ira I. Kaplan*, B.Sc., M.D., Director Division of Cancer, Department of Hospitals City of New York, Clinical Professor of Surgery, New York University Medical College, etc. Cloth. Pp. 528. Price, $4.50. Chicago: The Year Book Publishers, Inc., 1939.

A review of the literature on roentgendiagnosis to be of value both to the roentgenologist and the general diagnostician must present reproductions of the original x-ray films that show the finest details for proper interpretation. The part of the book devoted to diagnosis meets every such exaction to the greatest possible degree. To this should be added that in addition to the numerous reproductions there are also many photographic illustrations of conditions exposed to the naked eye and of apparatus and appliances. The abstracts of the world literature are given at sufficient length to offer the salient features of the original publications. There are also many case reports and not a few editorial comments especially with reference to difficult differential diagnostic problems.

All that has been said for the section on diagnosis applies with equal force to the section on radiation therapy, but it should not be overlooked that there is also included a number of abstracts dealing with radiation biology and radiation physics. Each section is preceded by an editorial introduction which calls attention to the many new and important problems contained in the literature, the one for the therapeutic section being a veritable essay from the facile pen of Dr. Kaplan. As these introductories do not lend themselves to a review, they must be read in the original for their highly informative value. When it is considered that the subject and author indices cover no less than 12 closely printed pages, one obtains an idea of the many subjects reviewed in this year's annual. The authors are to be felicitated for the meticulous care with which they have culled the literature, while the publishers merit high praise for their great expenditure for the more than 500 artistic illustrations and for the excellence of the mechanical make-up of this year book.

MANUAL FOR DIABETIC PATIENTS. By *W. D. Sansum*, M.D., Chief of the Staff of The Sansum Clinic and Director of Metabolic Research of the Santa Barbara Cottage Hospital; *Alfred E. Kochler*, Ph.D., M.D., Member of the Staff of the Sansum Clinic and Member of the Metabolic Research Staff of the Santa Barbara Cottage Hospital; and *Ruth Bowden*, B.S., Dietitian of The Sansum Clinic, Santa Barbara, California. Cloth. Pp. 227, with nine illustrations and two colored plates. Price, $3.25. New York: The Macmillan Company, 1939.

Considering the chronicity of diabetes in adults, who naturally are compelled to readjust their lives in order to prevent serious consequences, a book that will enlighten them on the fundamental problems involved should prove very useful to them and indirectly to their medical advisers. The Sansum Clinic has long pursued a policy of giving instructional lectures to its patients, and this book represents an elaborate and comprehensive review of such of the fundamentals of diabetes which the authors consider essential for patients to know in order to secure their cooperation after they leave the clinic or the physician's care, as the case may be. Divided into two parts, the first (15 chapters) takes up the history, nature, diagnosis, complications, tests, insulin, reactions, while the second part (7 chapters) considers a number of problems pertaining to the dietetic management of the disease. An appendix presents tables of food values, a form for periodical reports to the attending physician and a glossary. The book has a good index for orientation. For the purpose intended this volume is decidely of value especially when one has to deal with intelligent patients who appreciate the fact that they must fully cooperate with their physician to derive the full benefit from the modern methods of treating diabetes mellitus.